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Report on the Test of Dispersal of Turbojet Aircraft Departure Tracks at Washington National Airport (1983-84)

Volume I: Summary Report

October 1984

Federal Aviation Administration,
Metropolitan Washington Airports
and
Metropolitan Washington Council of Governments

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and
Metropolitan Washington Council of Governments

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Foreword

This report is Volume I of a two-volume set describing the analysis of aircraft noise before, during and after the test of the so-called "Scatter Plan," a dispersal of flight tracks for turbojet aircraft departing from Washington National Airport. The test, conducted by the Federal Aviation Administration (FAA) at the request of the Metropolitan Washington Council of Governments, took place from October 24, 1983, through January 7, 1984.

Volume I presents analysis of data collected in the course of the test. Volume II, the Technical Appendix, consists of a compilation of field sheets, survey forms, and details of the field noise measurement program and the community attitudinal survey. Volume II is available on a loan basis to agencies or individuals wishing to conduct additional analyses. Access to this volume may be attained by contacting the Federal Aviation Administration, Metropolitan Washington Airports (MWA). The level of detail and the bulk of this material makes it inappropriate to include it in the primary report.

The conduct of the field work and the analysis of the data were a joint undertaking of the Federal Aviation Administration, MWA; and the Metropolitan Washington Council of Governments (COG). The FAA participated in the computation and field monitoring of aircraft noise, and production of the report; the COG responsibilities were primarily in connection with the community attitudinal surveys. A separate report on the attitudinal survey is reprinted at the back of this volume.

The purpose of this report is to present the data collected during the test for the information of and interpretation by the interested public. The report does not include conclusions or recommendations on maintaining or changing the flight paths at Washington National Airport.

Technical work was performed by:

- Staff of the Federal Aviation Administration,
- Howard Needles Tammen & Bergendoff (HNTB), consultants to the FAA,
- Staff of the Metropolitan Washington COG,
- Bolt Beranek & Newman (BBN), consultants to the COG.

I. INTRODUCTION

A. Background

Aircraft noise is a continuing problem facing the Metropolitan Washington area. There have been, over a period of many years, two different spheres of activity to address these regional aircraft noise matters. The first came to be known as the Metropolitan Washington Airports Policy process. That process addressed a broad array of policy issues surrounding Washington National and Dulles International Airports, including the noise issue at National. It resulted in the issuance, in late 1981, of a broad statement of Federal policy on the future operation of the airports, together with a set of regulatory steps which constrained the growth of Washington National Airport. In general, the policy established the principle that the region's growth in air transportation would henceforth occur at Dulles.

The second sphere of activity recognized that, while National's growth might be constrained, its continuing level of flight activity would continue to be the source of annoyance to many of the airport's neighbors and that there should be a continuous effort to minimize that annoyance. It was from this second sphere of activity that the concept of a scatter plan came.

The flight paths currently used at Washington National Airport for most aircraft operations follow the Potomac River, thereby concentrating noise in the river corridor, both north and south of the airport. The Federal Aviation Administration (FAA) and the Metropolitan Washington Council of Governments (COG) have been engaged in a cooperative effort over a number of years to to determine if alternatives to the current routing of aircraft might reduce the impacts of aircraft noise in the Washington area.

In 1976, a steering committee made up of FAA, COG and airline representatives was formed to plan and direct a study of alternatives. This initial study focused on a noise exposure and impact analysis of the existing flight paths and of a conceptually different set of fan-out flight paths.[1] The fan-out concept was viewed as a way to redistribute departing aircraft flights over a wider geographic area, thereby reducing the noise exposure on some communities located near the Potomac River, while increasing overflights and noise in areas located away from the River. Following the public information meetings, the fan-out proposal was opposed by the majority of local citizens who addressed the issue, by their governments, and ultimately by COG.

On July 13, 1977, the COG Board of Directors asked the FAA to abandon further consideration of the alternative for spreading aircraft departures over a wider geographic area, and instead consider several alternative recommendations, including extension of flight paths along the river. The

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[1] Washington National Noise Analysis Summary of Findings, The Mitre Corporation, METREX Division, April 8, 1977.

FAA offered to try extending flight paths both north and south of the airport, but the COG asked the FAA to test the technique for southbound departures only.

In the summer of 1979, the FAA and the COG conducted a 49-day demonstration test extending the southbound turbojet departure flight path at National Airport. Under the south departure procedure, turbojets normally followed the Potomac River corridor at least 5 miles before turning toward their destinations. For the flight test, turbojets were held in the corridor until reaching a point 10 miles from the airport, then directed toward their destinations. During the test period, noise monitoring data and telephone survey information were collected in the areas south of the airport. The test results were published in May 1980[2] and made available to the public. A public hearing concerning the test results was conducted by the COG on May 28, 1980, and the COG decided not to recommend implementation of the southbound extension procedure.

The COG had also held a public hearing on March 26, 1980, to gain public input on the fan-out concept that had been previously rejected. On April 9, the COG Board of Directors requested the FAA to develop a study design for an alternative flight path (scatter pattern) demonstration test to the north of National Airport. This would be in accordance with the general guidelines requested by the Montgomery County Council. The test was designed to distribute the aircraft and noise impacts as equitably as possible among affected local jurisdictions. The FAA was also requested to consider a plan proposed by a local community group known as Coalition on Airport Problems (CAP). On June 11, 1980 the COG Board of Directors further requested the FAA to consider the possibility of combining a study design for a northbound and southbound scatter pattern test for departing turobjet aircraft.

The FAA submitted the requested study design[3] in November 1980. However, the COG Board in its December meeting decided not to request a test of the plan, but to consider possible alternatives being developed by CAP and the Prince Georges County Advisory Board on National Airport Operations. The proposal developed by these community groups was issued on March 31, 1981; the COG Board, on May 13, 1981 voted to request the FAA to conduct a demonstration test of the proposal.

The plan proposed shifting of the turn areas for turbojets leaving the Potomac River corridor closer to National Airport. Turbojets would commence turning from the Potomac River corridor in approximately the Rosslyn/Georgetown Reservoir areas on departures to the north and at the Woodrow

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[2] Extension of the Southbound Turbojet Departure Flight Path at Washington National Airport - Noise Abatement Test, Federal Aviation Administration and Metropolitan Washington Council of Governments, May 1980.

[3] Study Design for a Scatter Pattern Demonstration Test from National Airport, FAA, October 31, 1980.

Wilson Bridge for departures to the south. Preparations for conducting the test were underway when the August 1981 air traffic controllers' strike forced the FAA to postpone initiation of the test. (See the FAA letter to the COG dated November 18, 1981, in Appendix A.)

In 1983, the FAA determined that the air traffic system had recovered sufficiently from the strike and that a test of the scatter plan was feasible and safe. An environmental assessment on the proposed test was prepared[4], which resulted in the issuance of a Finding of No Significant Impact. About 650 written comments were received, nearly evenly divided between support for and opposition to the test. The City of Alexandria brought litigation to stop the test but the courts ruled that the FAA could conduct the test. In July 1983, the COG Board reaffirmed its support and the test was scheduled to begin in the fall of 1983.

B. Purpose of Test

The purpose of the test was to evaluate changes in the aircraft noise environment and changes in community perception of aircraft noise resulting from use of the scatter plan departure tracks for turbojet aircraft.

C. Approach

The test consisted of four primary elements:

- implementation of the procedure for a period sufficient to complete field observations, but not more than 90 days, as specified in COG's request for the test program;

- a program of field measurement of aircraft noise at selected locations to determine what actual changes in aircraft noise occurred as a result of the test;

- calculation of aircraft noise for the area subject to significant levels of aircraft noise for test and non-test flight tracks;

- a community attitudinal survey to determine whether and how public perception of aircraft noise changed under test conditions.

The comparison of the aircraft noise environment for non-test and test conditions included several different means of describing aircraft noise, namely:

- calculation of the Ldn average day-night sound level, a widely-accepted measure of aircraft noise;

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[4] Environmental Assessment for a Test of Amended Turbojet Departure Paths at Washington National Airport, Federal Aviation Administration, May 1983.

- calculation of the total time in an average day that aircraft noise levels exceeded a threshold of 75 dBA;

- measurement of hourly average noise levels, maximum noise levels, and time-above-threshold levels for selected monitoring sites;

- reporting the number of aircraft overflights experienced at the monitoring sites.

During the course of the test, field observations of noise levels and of operational practices provided more information on actual use of flight tracks, profiles and thrust management techniques than was previously available. The data used to calculate aircraft noise incorporated the operational practices that were identified during the observations. Because the Ldn and Time-Above-Threshold noise contours presented in the report are derived from actual operations, they differ in minor ways from contours presented in earlier reports, including the 1983 Environmental Assessment on the proposed test.

II. DESCRIPTION OF SCATTER PLAN TEST

A. General Description

This section of the report describes the changed procedures and flight tracks, the monitoring system used to measure noise changes, and the community survey procedure used to ascertain changing public perceptions of aircraft noise under test and non-test conditions.

The test commenced at 7:00 a.m., October 24, 1983. Under the terms of the original agreement, the test could have been conducted for a period of up to 90 days. Sufficient data was collected prior to that time and the test was terminated at 10:00 p.m., January 7, 1984[1].

B. Flight Tracks and Profile

1. Existing (Non-Test) Departure Flight Tracks

The noise abatement procedures for jet aircraft departing Washington National Airport (DCA) are shown in Figure 1. The procedures specify that jet aircraft departing during north operations follow a route northwest over the Potomac River or northeast over the Anacostia River. Jet aircraft departing t the northwest follow the Potomac River to the vicinity of the Georgetown Reservoir, weather permitting. At that point they continue to follow the river or follow the 326 Radial[2] of the Washington VOR (the course that most closely approximates that of the river) until approximately ten miles from the airport. Then they are vectored to their departure route. Aircraft using the Anacostia River route follow the river to 5 DME before being vectored to their departure route.

During south operations, noise abatement procedures require jet aircraft to depart south over the Potomac River and follow the river, or follow a heading of 183°, for at least five miles before being vectored to their departure route.

Aircraft generally take off and land into the wind. On an annual basis, aircraft depart DCA toward the north approximately 55 percent of the time and toward the south approximately 45 percent of the time. The incidence of south winds increases during the summer months, while the incidence of north winds is higher in the winter.

The ground paths followed by departing turbojet aircraft on a typical day prior to the scatter test are depicted in Figures 2 and 3, which show actual radar tracks. (These computer-generated plots track aircraft only to

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[1] See Appendix A for correspondence initiating and ending the test.

2 The designation has since been changed to "328 Radial" because of changes in magnetic deviation, but the track remains the same.

Term-68

TERMINAL AREA GRAPHIC NOTICE
(NOT TO BE USED FOR NAVIGATION)

WASHINGTON NATIONAL AIRPORT NOISE ABATEMENT PROCEDURES

DEPARTURES

JET AIRCRAFT - From take off climb to 1500' At 1500' reduce power to a target setting computed for hot day conditions at maximum gross take off weight to give approximately 500' FPM climb (In lieu of 1500' as the point of power reduction, the 2 mile DME fix* when departing northwest or northeast or the 3 mile DME fix* when departing south may be used) Maintain reduced power until past a 10 mile DME arc* Upon reaching the 10 mile DME arc* gradually increase power to normal climb settings Follow the Potomac or Anacostia River routes described below unless otherwise advised by ATC

ATC CLEARANCE TO "CONTINUE CLIMB" IN NO WAY ELIMINATES THE REQUIREMENT TO COMPLY WITH NOISE ABATEMENT PROCEDURES, EXCEPT THAT THE SPECIFIC ATC INSTRUCTION TO "EXPEDITE CLIMB" RELEASES THE PILOT FROM FURTHER COMPLIANCE WITH NOISE ABATEMENT PROCEDURES

NORTHWEST - Potomac River to abeam Georgetown Reservoir thence continue over the river or via 326° Radial* until past the 10 mile DME arc *

NORTHEAST - Anacostia River to the 5 mile DME fix*, continuing at reduced power past a 10 mile DME arc*

SOUTH - Potomac River to the 5 mile DME fix*, continuing at reduced power past a 10 Mile DME arc*

(*Washington (DCA) VOR/DME)

1 AND 2 ENGINE PROPELLER AIRCRAFT - Follow Potomac or Anacostia Rivers as appropriate From take-off climb to 1500' prior to turning on course unless instructed to turn sooner by ATC

4 ENGINE PROPELLER AIRCRAFT Follow Potomac or Anacostia Rivers as appropriate From take off climb to 2000' prior to turning on course unless instructed to turn sooner by ATC

ARRIVALS

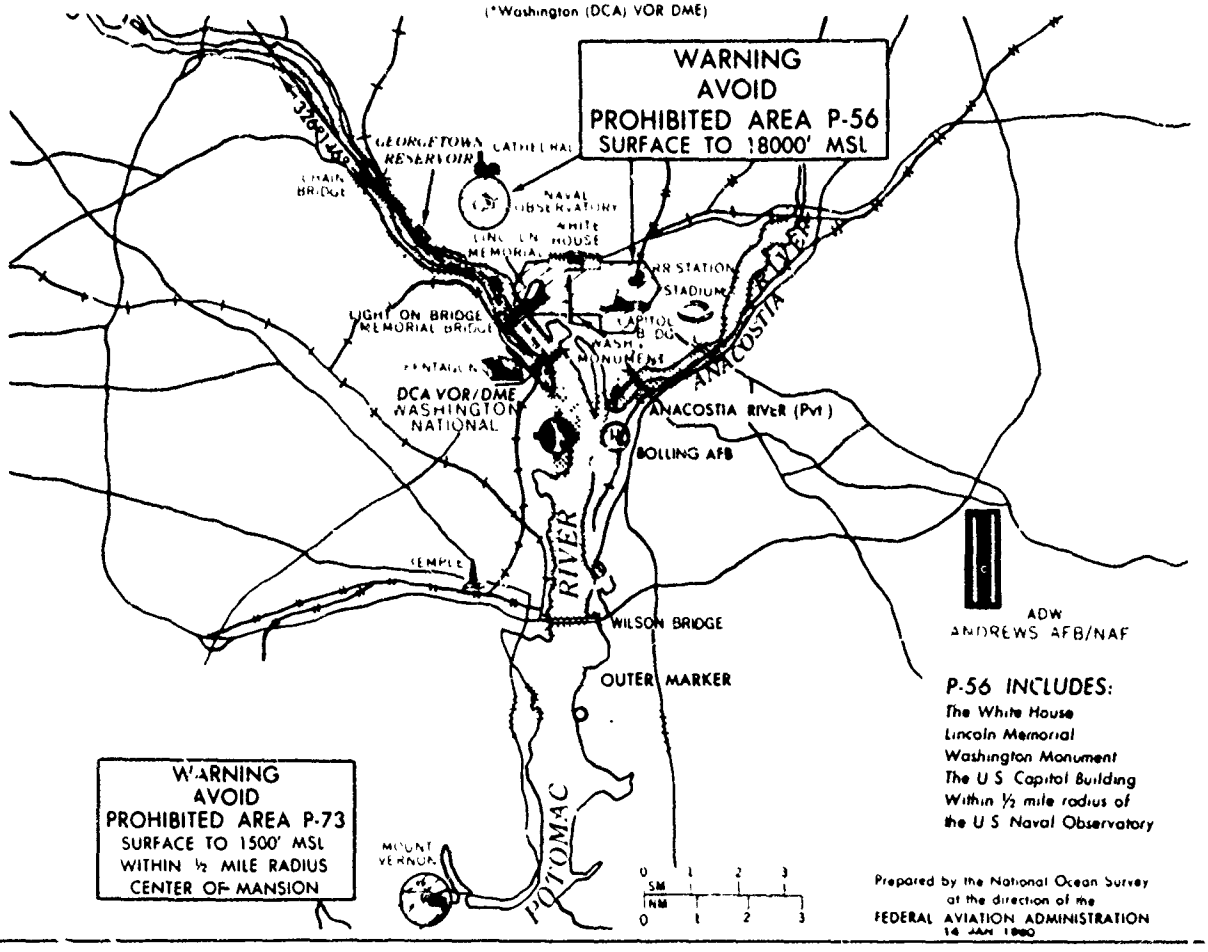
Aircraft shall be vectored so as to continue their approaches over the rivers while being spaced within the traffic flow

Aircraft making IFR approaches from the northwest shall be cleared for a River Approach (Visual) when weather is 3500' and 3 miles or better Radar vectors will be provided to the final approach course When cleared for a River Approach, aircraft may visually follow the river to the airport or may proceed via the DCA VOR 326° radial (146° inbound) or via the LDA RWY 18 approach to abeam Georgetown Reservoir or the DCA 4 mile DME then visually follow the river to the airport

A light on Memorial Bridge is installed to assist pilots in staying over the Potomac River during approaches from the northwest

Aircraft making IFR approaches from the south shall be cleared for a Mount Vernon Approach (Visual) when weather is 3000' and 4 miles or better When cleared aircraft will proceed inbound via 187° radial* (007° inbound) to abeam Oxon NDB or 5 6 DME fix* then will visually follow the river to the airport

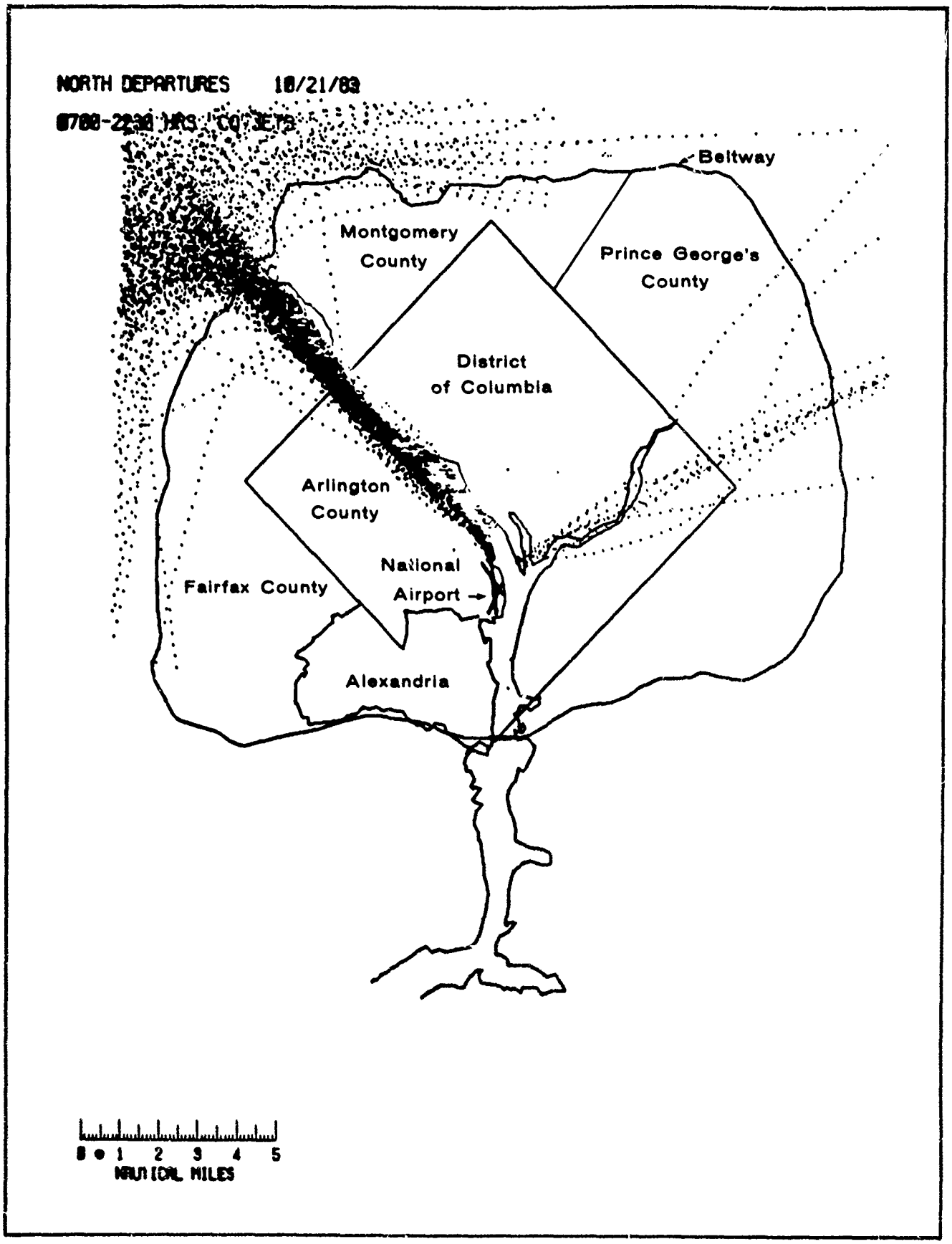
(*Washington (DCA) VOR/DME)



Prepared by the National Ocean Survey
at the direction of the
FEDERAL AVIATION ADMINISTRATION
14 JAN 1960

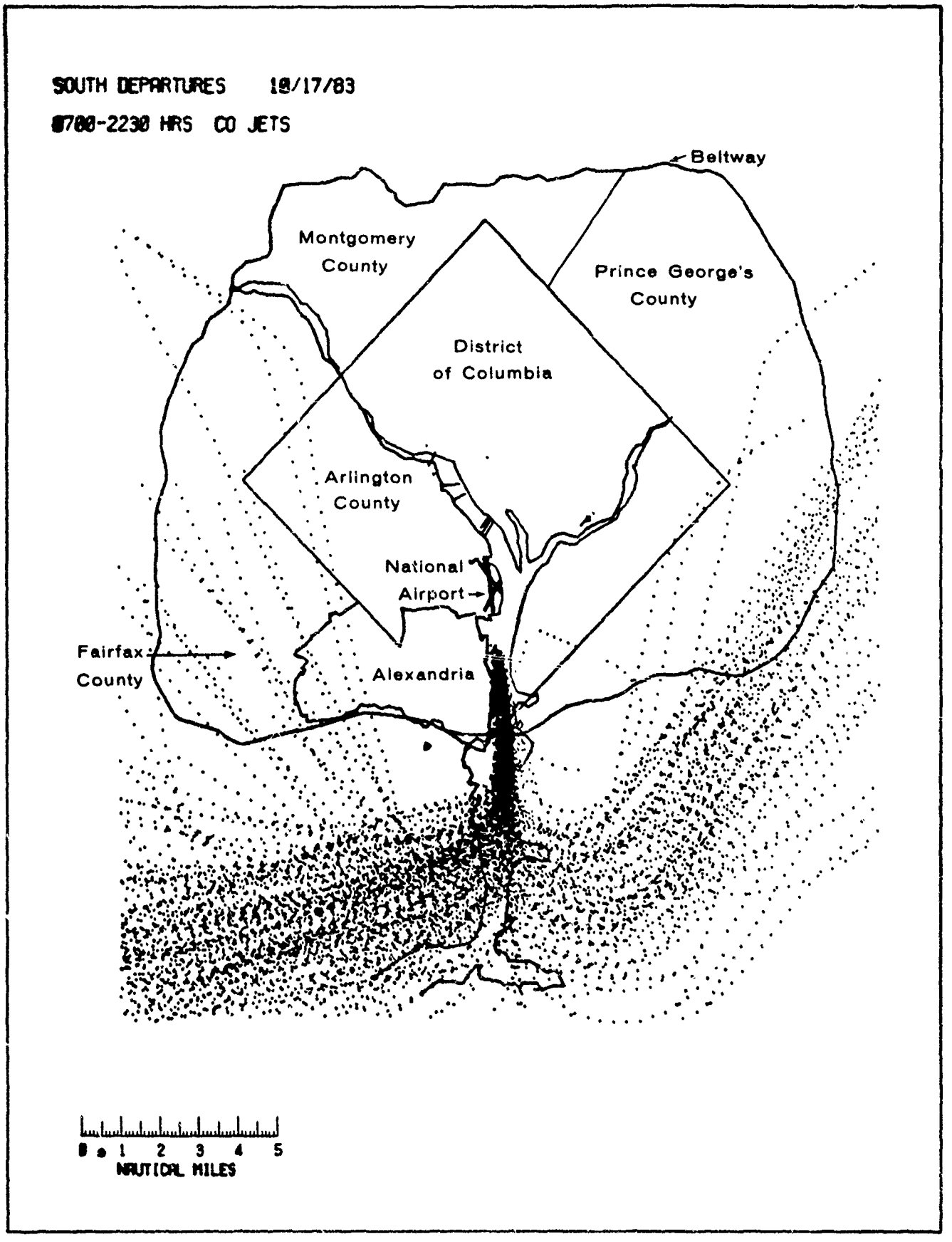
Washington National Airport
Noise Abatement Procedures

Figure 1



Actual Flight Tracks — North Departures
Pre-Test (Oct. 21, 1983 7 a.m.-10:30 p.m.)

Figure 2



Actual Flight Tracks — South Departures
Pre-Test (Nov. 17, 1983 7 a.m.-10:30 p.m.)

Figure 3

an altitude of 7000 feet and to the edge of a rectangular area covered by the mapping program.) Figure 2 presents a one-day sample of flight tracks flown by turbojet aircraft departures during northerly operations (takeoffs to the north, landings from the south) under pre-test conditions. Figure 3 shows the paths flown on a typical day of southerly operations under pre-test conditions.

Noise abatement procedures specify that aircraft should follow the Potomac and Anacostia rivers. Aircraft do not fly precisely over the middle of the rivers because of wind, reduced visibility conditions, nose high attitude of the aircraft, differences in airline or pilot techniques, and variations in the sensitivity of navigational equipment. When the ceiling is below 3000 feet and/or the visibility is less than 3 miles, aircraft are routed to fly the departure radial, which does pass over Rosslyn. In addition, air traffic controllers may turn aircraft from the noise abatement flight paths at any time to ensure proper separation of aircraft. Actual observed flight tracks, including the percentage of flights deviating from the river course, were used in calculation of test and non-test aircraft noise.

2. Scatter Plan Flight Tracks

The flight tracks used during the scatter plan were based upon those included in the original proposal made to COG[3], with minor alterations made by the FAA required for implementation of the plan. The changes to the COG proposal were described in the Environmental Assessment.

The COG proposal addressed alternative departure routes and thrust procedures for turbojets departing Washington National Airport, both to the north and south of the airport. The portion of the proposal dealing with aircraft flight tracks generally consisted of the following:

North Departures:

- Aircraft would fly a middle of the river visual course (or 326 radial in reduced ceiling and visibility conditions) for a distance of two miles (and at least 1500 feet altitude) instead of approximately ten miles under the existing procedure. Aircraft with westerly destinations would then turn to their departure routes at this point.

- Aircraft with northeasterly destinations which could turn up the Anacostia River would continue to do so. Other northeasterly bound planes would continue north along the Potomac River until past the restricted airspace overlying the U.S. Naval Observatory.

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[3] Proposal For a Flight Path Demonstration Test From Washington National Airport, Metropolitan Area Coalition on Airport Problems and Prince George's Advisory Board on National Airport Operations, March 25, 1981.

South Departures:

- Aircraft would follow a middle of the river visual course (or 183 radial in reduced ceiling and visibility conditions) for a distance of three miles (and at least 1500 feet altitude) and then turn (over the Woodrow Wilson Bridge and Beltway) to their departure routes.

The FAA reviewed the proposed test plan and determined that it was operationally feasible and safe, subject to the following modifications (with respect to aircraft flight tracks):

- During north operations, turbojet departures would be instructed to fly the river visually when the cloud ceiling was 2500 feet or higher and the visibility three miles or better. Below either of these minima, aircraft would be instructed to depart northwest via the 326 radial of the Washington VOR.

- During south operations, turbojet departures would be instructed to depart south via the 183 radial of the Washington VOR regardless of cloud ceiling, as the radial approximates the center of the Potomac River.

- The mileage figures for the earliest turning points would be converted to distances from the Washington VOR, located on the airport. These distances would be 2.2 NM for turns during a north operation and 4 NM for turns during a south operation. These distances would determine the earliest point at which an aircraft could be vectored by ATC away from the Potomac River corridor. Altitude would not be the controlling factor, since it was anticipated that most aircraft would be at or above 1500 feet prior to reaching the recommended turn points.

The scatter plan test was conducted from October 24, 1983, through January 7, 1984. For most of the days that the test was in effect, radar plots of actual flight paths were generated[4]. While there was some variation in dispersal patterns on a day-to-day basis, once the air traffic controllers and pilots using the new procedures became familiar with them, the same general flight patterns were followed for the duration of the test. Figures 4 and 5 depict typical days of departures under the test conditions during northerly and southerly operations, respectively.

3. Post-Test Flight Tracks

After the scatter test was terminated on January 7, 1984, turbojet aircraft were returned to their normal departure tracks. Figures 6 and 7 show the radar plots of actual flight paths during northerly and southerly operations, respectively, for typical days during the post-test period.

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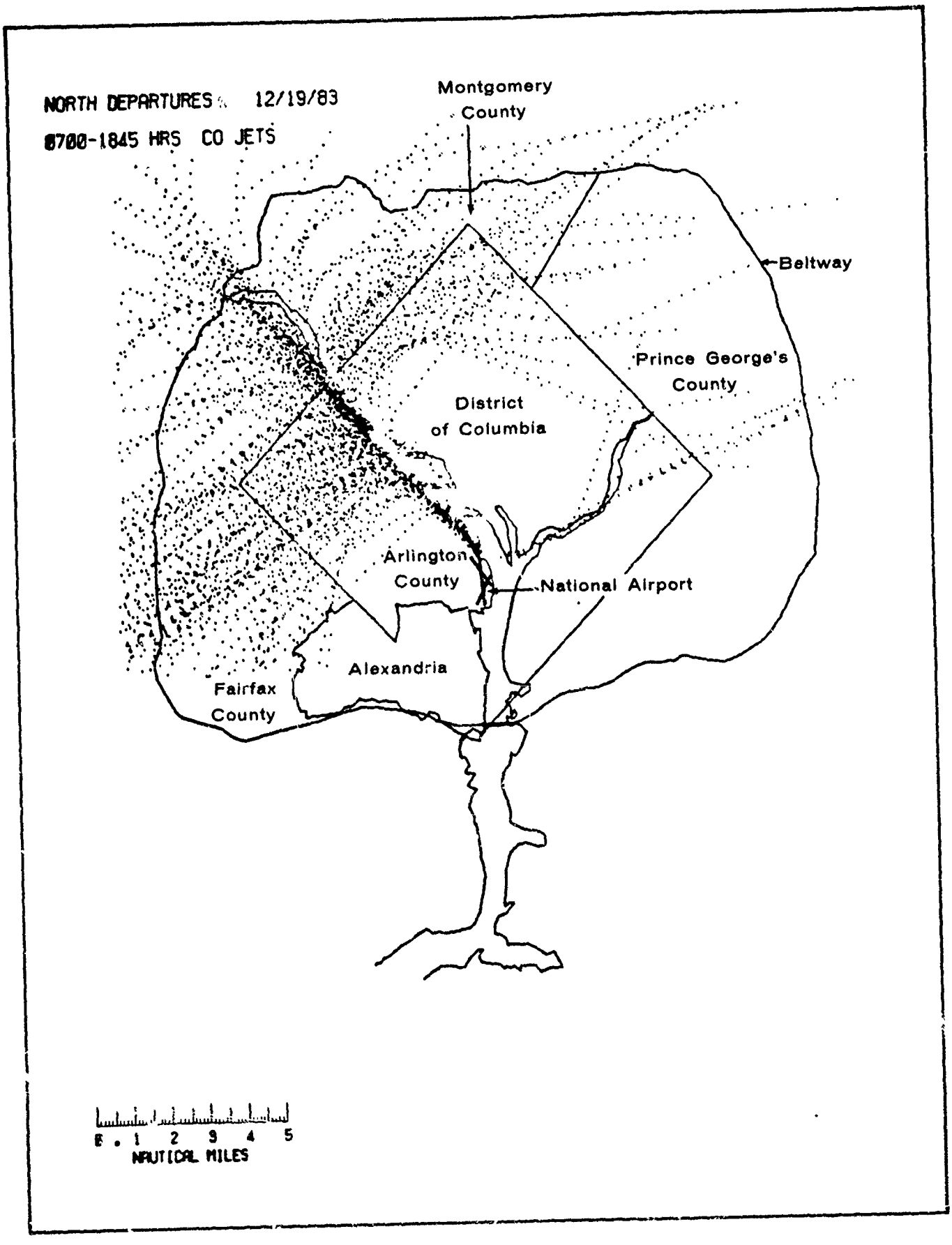
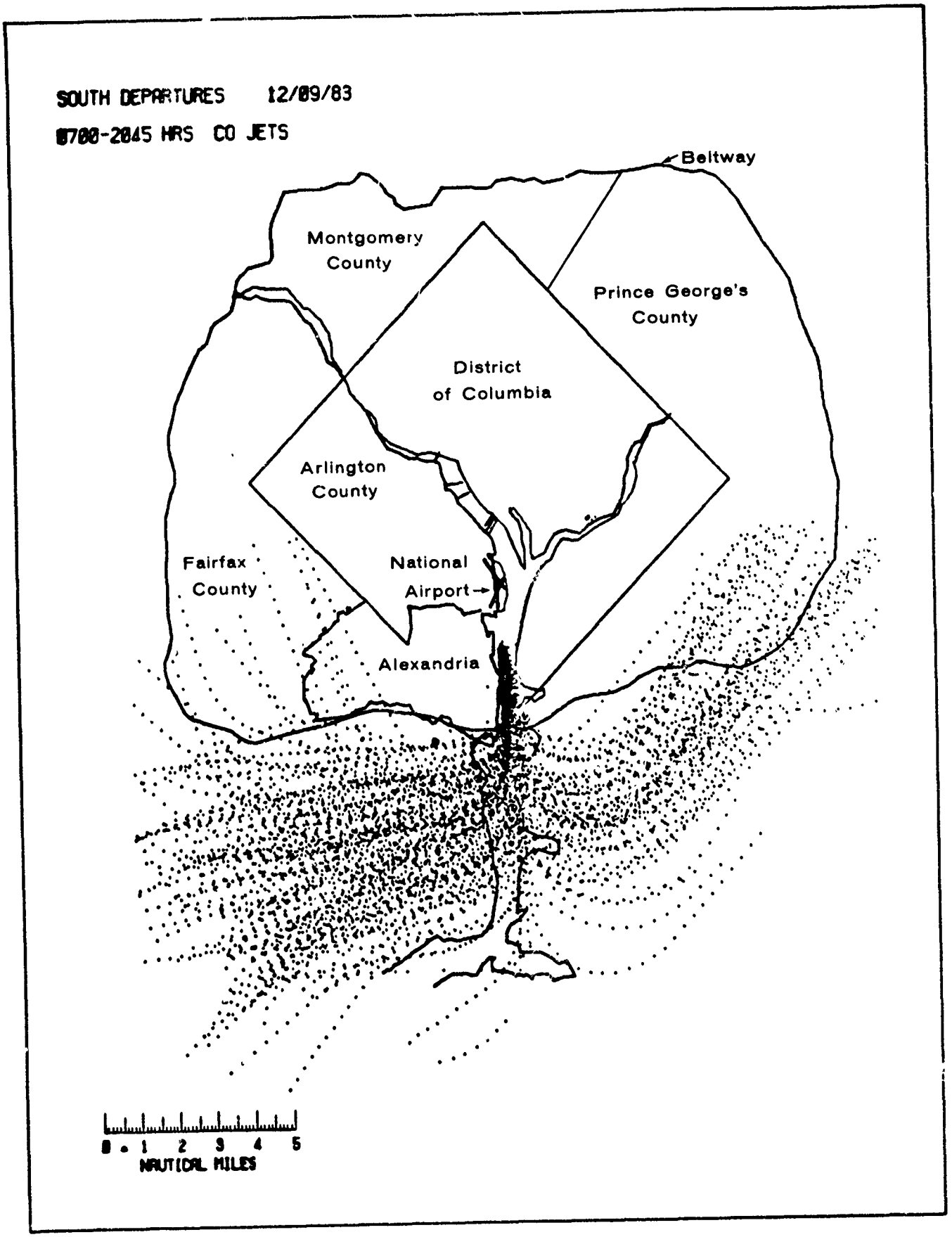
[4] These plots are shown in Volume II, the Technical Appendix.



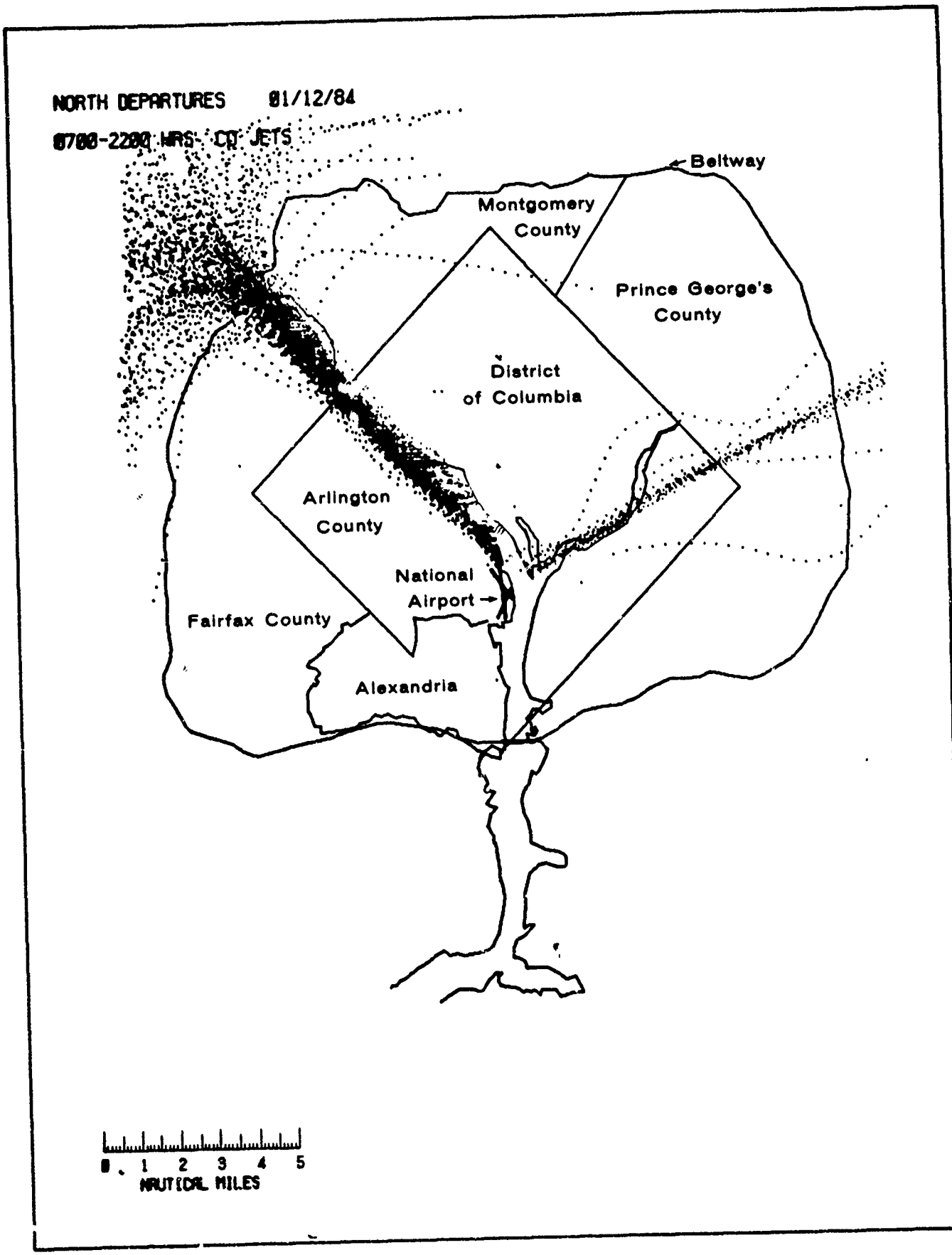
Actual Flight Tracks — North Departures
Test (Dec. 19, 1983 7 a.m.-6:45 p.m.)

Figure 4



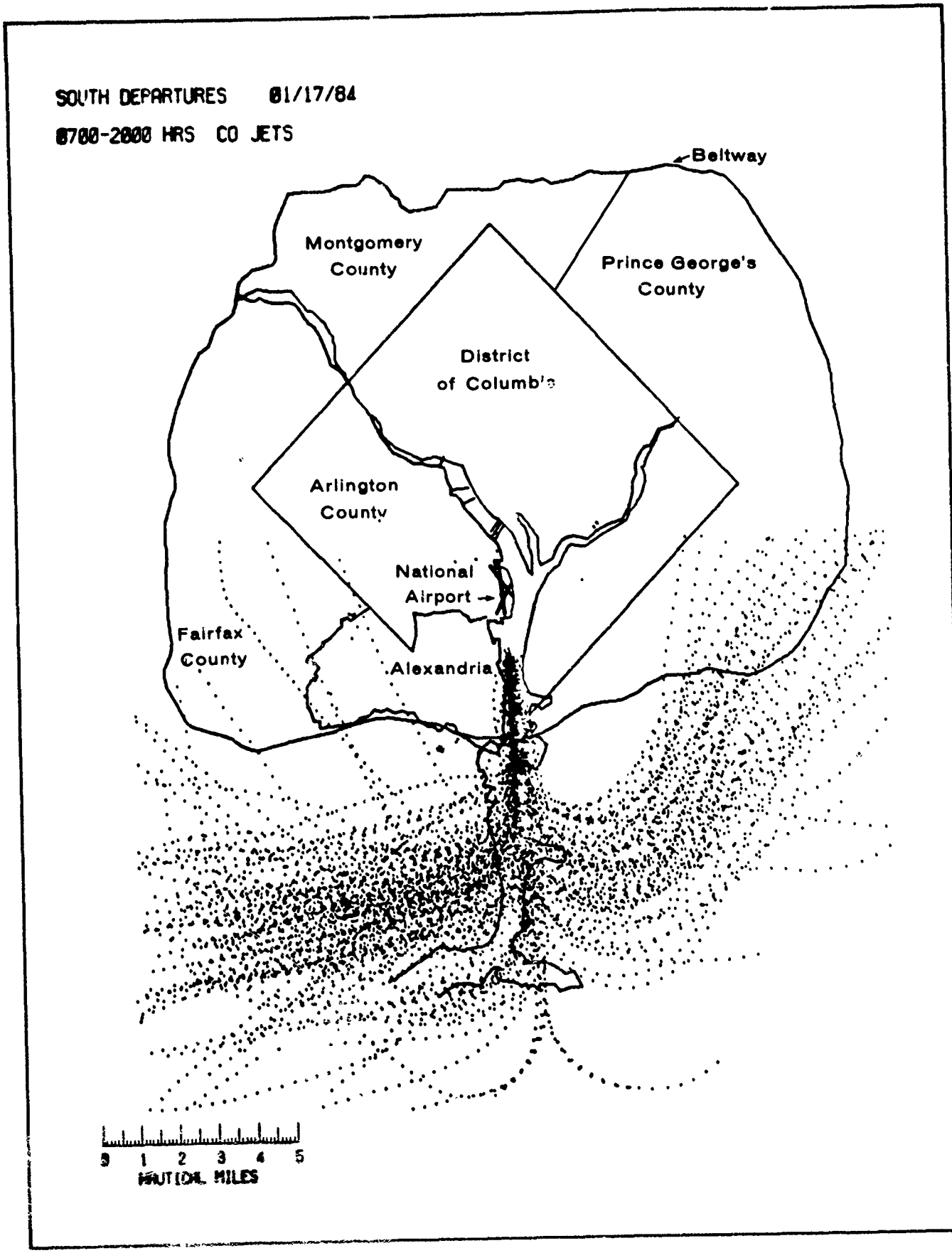
Actual Flight Tracks — South Departures
Test (Dec. 9, 1983 7 a.m.-8:45 p.m.)

Figure 5



Actual Flight Tracks — North Departures
Post-Test (Jan. 12, 1984 7 a.m.-10 p.m.)

Figure 6



Actual Flight Tracks — South Departures
Post-Test (Jan. 17, 1984 7 a.m.-8 p.m.)

Figure 7

4. Departure Profile

The DCA noise abatement procedures address both the aircraft tracks and the departure profile -- the rate of climb and engine thrust settings. The COG proposal had requested that changes be made in the specified departure profile as well as in the tracks of departing aircraft. To evaluate better the noise impacts attributable to changes in departure tracks, the decision was made not to alter the departure profile during the scatter plan test.

C. Field Noise Monitoring Program

1. Purpose

The field noise monitoring program was undertaken to determine actual changes in community noise levels during the test of revised turbojet departure procedures.

2. Monitor Site Location and Occupancy

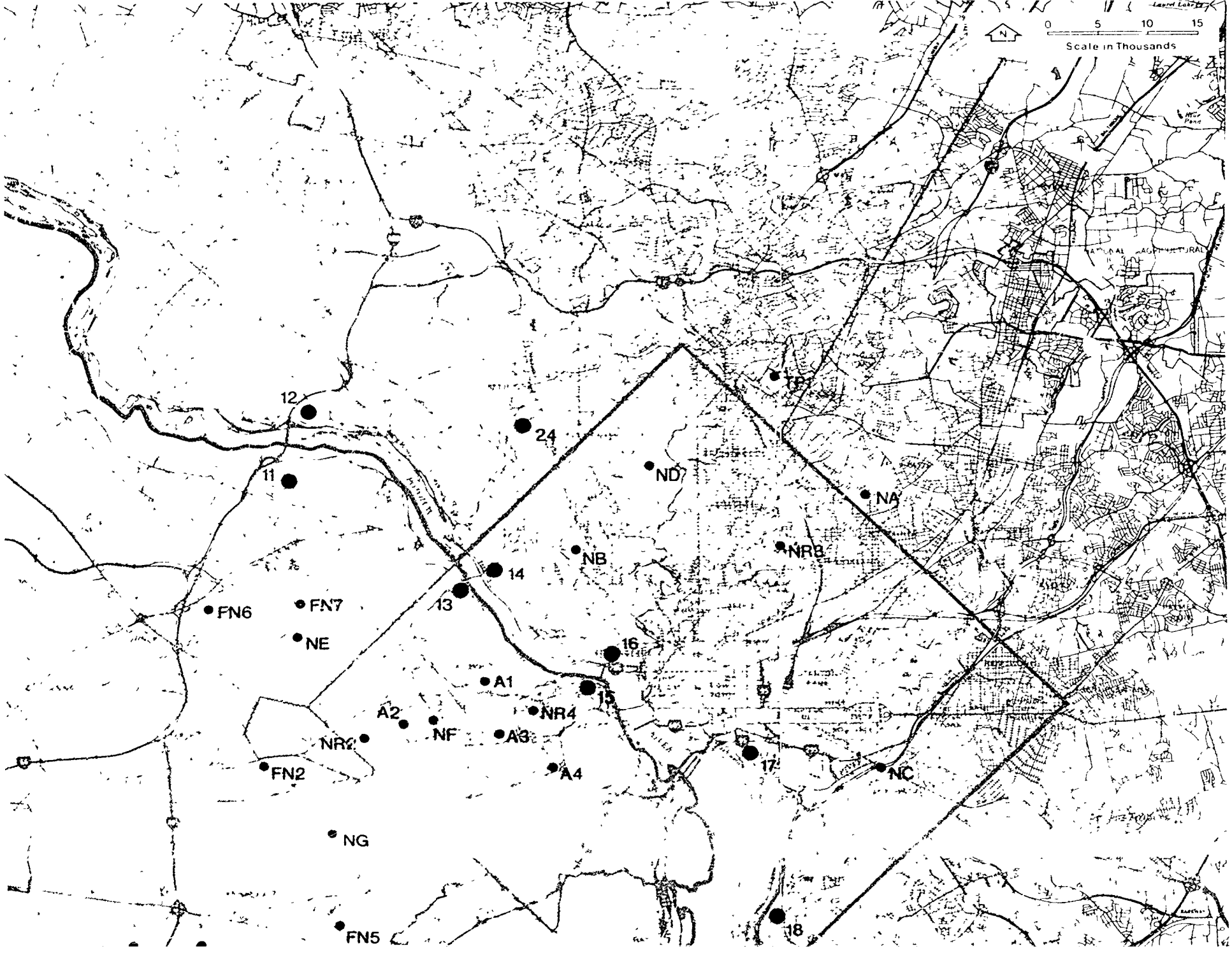
Noise levels were monitored during three periods: before the testing of the scatter plan (referred to as the Pre-Test period), from September 26 to October 22, 1983; during the scatter plan test, from October 26, 1983, to January 6, 1984; and following the test (referred to as the Post-Test period), from January 12 to March 27, 1984.

Noise was monitored at 48 sites in the Washington metropolitan area. Fifteen of these sites are the locations of permanent monitors maintained and operated by the FAA. There were also 13 temporary sites established for the Scatter Plan Test, and 20 mobile sites monitored for shorter periods of time during the test. The temporary and mobile sites were manned by field observers while observations were in progress. The sites are listed in Table 1 and their locations are shown on Figure 8. (For convenience to the reader in reviewing the data, Table 1 and Figure 8 are reprinted as foldouts in Appendices E and F in the back of this report.)

The FAA's permanent monitors record and process noise information continuously over 24-hour periods. From these monitors, data was abstracted for time periods similar to those for which the temporary and mobile sites were occupied.

For the Scatter Plan Test, 12 temporary sites were selected initially in locations where the changes in flight patterns were expected to have the most effect on aircraft noise levels. The initial listing of proposed temporary sites was coordinated by the COG with the area jurisdictions. As a result of comments received, the locations of some temporary sites were changed and one site was added. It was decided also to make spot recordings at "mobile" sites, to supplement the longer-term observations at the permanent and temporary sites.

Through the course of the study, requests for additional observations were received from Fairfax County, Arlington County and Alexandria.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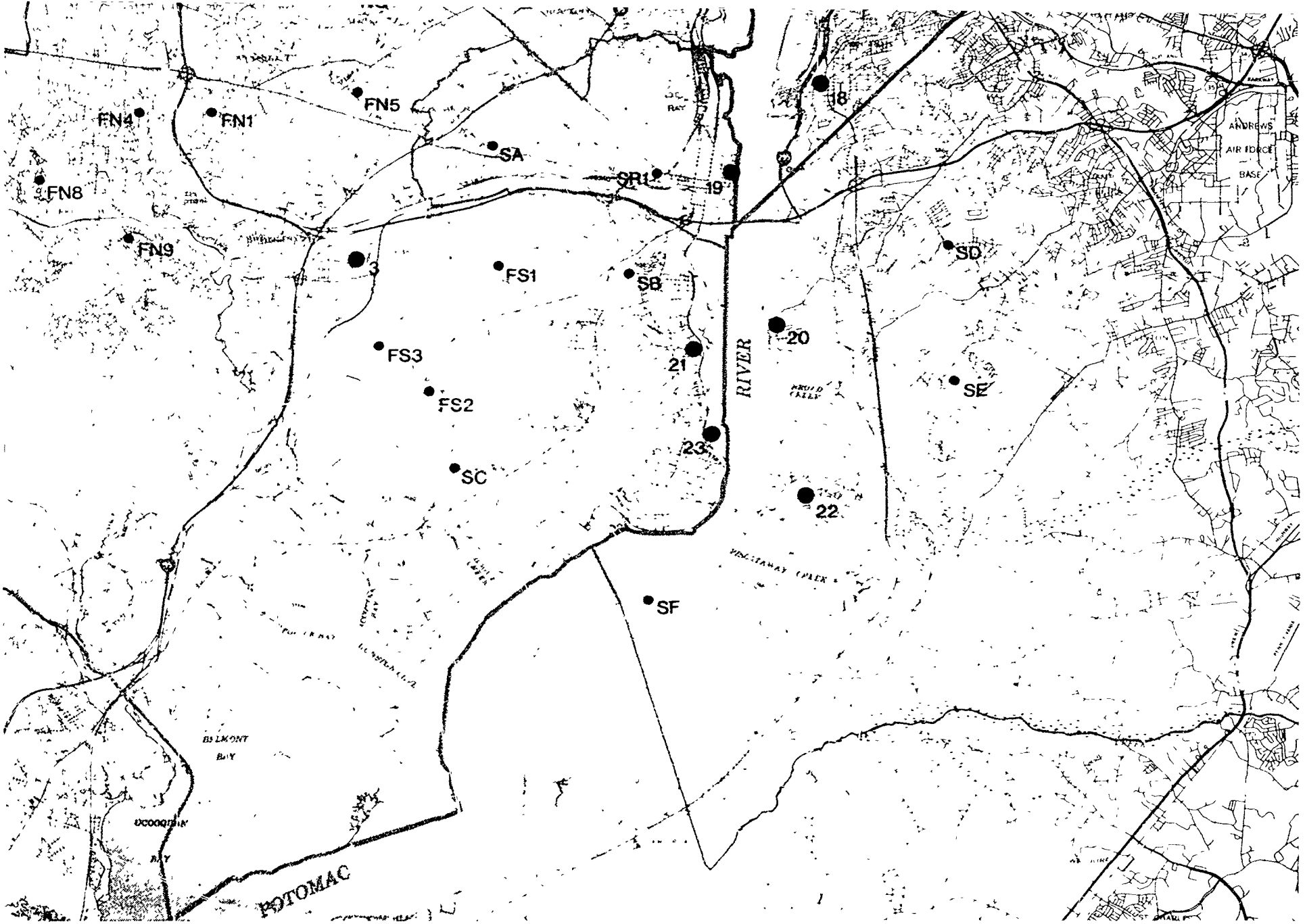


● Permanent Monitors

• Temporary and Mobile Monitors

TABLE 1

MONITORING LOCATIONS

Site No.	Jurisdiction/Community	Streets/Landmark
FAA PERMANENT MONITORING SITES		
11	Fairfax County/Langley Forest	Sorrell Street 200' east of Douglass Drive
12	Montgomery County/Cabin John	76th Street at Arden Road
13	Arlington/Chain Bridge	Northeast terminus of 36th Road
14	Washington/Potomac Palisades	Galena Place near Carolina Place, NW
15	Arlington/Rosslyn	Rolfe Street between 21st Road and dead end
16	Washington/Georgetown	35th Street and Volta Place, NW
17	Washington/Southwest	Fort McNair
18	Washington/Bellview	2nd Street 600' north of Chesapeake Street, SE
19	Alexandria/Old Town	Near Potomac River at foot of Oronoco Street/Founders' Park
20	Prince Georges County/Fort Foote	Fort Foote Road at FAA Communications Site
21	Fairfax County/Marlan Forest	Farrington Place and Burtonwood Drive
22	Prince Georges County/Tantallon	Tantallon Drive 500' east of Monterey Circle
23	Fairfax County/Waynewood	Alyce Place cul-de-sac south of West Boulevard
24	Montgomery/Chevy Chase Terrace	Langdrum Lane cul-de-sac at Little Falls Park
3*	Fairfax County/Springfield	Meriweather Lane at Thomas Drive

*Monitoring Equipment was moved to Springfield but maintained the name "Dulles 3".

TABLE 1 (CONTINUED)

Site No.	Jurisdiction/Community	Streets/Landmark
TEMPORARY MONITORING SITES, NORTH OPERATIONS		
N A	Prince Georges County/Avondale	LaSalle Road/Carroll Manor Nursing Home
N B	Washington/McLean Gardens	39th Street and Newark Street, NW
N C	Washington/Anacostia	Near Sousa Bridge at Anacostia River, SW
N D	Washington/Rock Creek Park	Glover Road and Military Road, NW
N E	Fairfax County/Kirby Park	Westmoreland Road near Lemon Road
N F	Arlington/Arlington Hospital	George Mason Road and 17th Street
N G	Fairfax County/Sleepy Hollow	Sleepy Hollow Road at Sleepy Hollow School
TEMPORARY MONITORING SITES, SOUTH OPERATIONS		
S A	Alexandria/Brookville	Holmes Run Parkway and South Pickett Sreet
S B	Fairfax County/Belleview	6400 Quander Road/Quander Road Center
S C	Fairfax County/Woodlawn Village	Fort Belvoir
S D	Prince Georges County/Oxon Hill	Bock Road near Tucker Ice Rink
S E	Prince Georges County/Fort Washington	1000 Allentown Road/Friendly High School
S F	Prince Georges County/Accokeek	3400 Bryan Point Road/National Colonial Farm

TABLE 1 (CONTINUED)

Site No.	Jurisdiction/Community	Streets/Landmark
MOBILE MONITORING SITES		
NR 2	Arlington/East Falls Church Park	North Roosevelt Street and 16th St.
NR 3	Washington/Soldiers' Home	North Capitol Street and Scale Gate
NR 4	Arlington/Lyon Village	Highland Street and Edgewood Street
SR 1	Alexandria/George Washington Park	Carlisle Drive
FN 1	Fairfax County/Annandale	Heritage Drive and Four Year Run/Ossian Hall Park
FN 2	Fairfax County/Devonshire Gardens	Graham Road/Devonshire School
FN 4	Fairfax County/Annandale	8415 Toll House Road/Wakefield Chapel
FN 5	Fairfax County/Annandale	6621 Columbia Pike/Mason District Park
FN 6	Fairfax County/McLean	Magarity Road/Westgate Park
FN 7	Fairfax County/McLean	1717 Melbourne Dr./Kent Gardens Sch
FN 8	Fairfax County/Burke	Burke Lake Road /Lake Braddock Park
FN 9	Fairfax County/Springfield	8600 Forrester Boulevard/Cardinal Forest School
FS 1	Fairfax County/Rose Hill Farms	6301 Rose Hill Drive/Rose Hill Sch.
FS 2	Fairfax County/Hayfield	7633 Telegraph Road/Hayfield School
FS 3	Fairfax County/Franconia	Beulah Street/Beulah Street Park
A 1	Arlington/Cherrydale	4100 N. Vacation Lane/Woodlawn Sch
A 2	Arlington/Westover	Washington Boulevard at Walter Reed School
A 3	Arlington/Ballston	Quincy Street/Quincy Playfield
A 4	Arlington/Ashton Heights	33 North Fillmore Street/Long Branch School
TP1	Montgomery County/Takoma Park	Piney Branch Road/Takoma Park Junior High School

Additional sites were added to respond to all of those requests. Not all of the sites were operational at the start of the test.

Measurements were made at the temporary and mobile sites on weekdays from 8:00 to 11:00 a.m. and 3:00 to 6:00 p.m., the hours of highest traffic at the airport. The temporary sites were additionally occupied for periods in the evening (6:00 to 9:00 p.m.) and on weekends (Saturday 8:00 to 11:00 a.m. and 3:00 to 6:00 p.m.) to provide information on differences in noise levels at those times from the daytime/weekday times used for primary evaluation. Noise measurements were taken at a temporary or mobile site only when the departure direction from the airport affected that site.

At each site, monitoring during each of the three periods (Pre-Test, Test, Post-Test) was terminated after the collection of data at the site was sufficient to determine the environmental noise within +/- 5 dB with a 95 percent confidence level. At each site monitoring was done until three weekday mornings, three weekday evenings, and one weekend period were successfully measured. For most sites, this required multiple visits as a result of inclement weather or a shift of wind direction (changing the direction of departure) during an observation period.

3. Equipment

The FAA's permanent noise monitors consist of an EG&G Aircraft Noise Monitoring System. Each station transmits A-weighted sound levels to the noise monitoring system central processing unit located at Dulles International Airport. Microphones are mounted approximately 30 feet above ground level. The system incorporates computer software that continuously examines the accoustical data from each site and "selects" the aircraft noise events from the other environmental noise sources, based on amplitude, frequency and duration of a noise event.

The monitors used at the temporary and mobile sites were Gen Rad 1945 Community Noise Analyzers (CNA). Connected to each CNA was a microphone with windscreen, which was fed through a P-42 pre-amplifier. The microphones were elevated on tripods. The systems were calibrated in the laboratory and field-calibrated at the start and close of each session. After each session, the data stored in the CNAs was read and recorded by an HNTB engineer.

4. Data Recorded

For the permanent sites, continuous measurements of noise are maintained. Based on the amplitude, frequency and duration of the noise event, a determination is made as to which noise events are aircraft noises. The noise data is corelated with aircraft operational data derived from air traffic control information recorded on Automated Radar Tracking System (ARTS-III) tapes, permitting the height above the monitor and the slant range distance of any aircraft overflight to be related to the noise event at a monitor. The following daily data is also derived from information obtained at the permanent sites: Ldn and Leq, and levels of L1, L10, L50, L90, and L99.

At the 13 temporary and 20 mobile sites, measurements were made of the following noise levels: Lmax, Leq, L 0.1, L1, L10, L50, L90, L99, and Lmin. The monitors were manned during the hours the field observations were conducted, to record supplementary data on sources of noise (both aircraft and non-aircraft), and also to maintain the security of the monitoring equipment. The persons assigned to operate the monitors were trained by FAA and HNTB personnel (a copy of equipment operating instructions is included in Volume II), and were visited in the field by professional staff to confirm that the equipment was properly located and properly operated. The technician at the site maintained a log of each aircraft noise event, recording the time, maximum noise level, duration of maximum noise level, type of aircraft, and whether the aircraft was arriving or departing National Airport. Notes were also made on the weather and wind conditions and any loud non-aircraft noises that occurred. These observations were made to ensure that the noise events being measured were flights departing from National Airport, and to record the number of overflights.

D. Community Attitudinal Survey

In addition to the noise monitoring program, a survey of community attitudes towards aircraft noise was conducted for the COG by its consultant, Bolt Beranek and Newman Inc (BBN). The study included four rounds of telephone interviews, carried out before, during and after the test. The focus of the interviewing was aircraft-noise-induced annoyance.

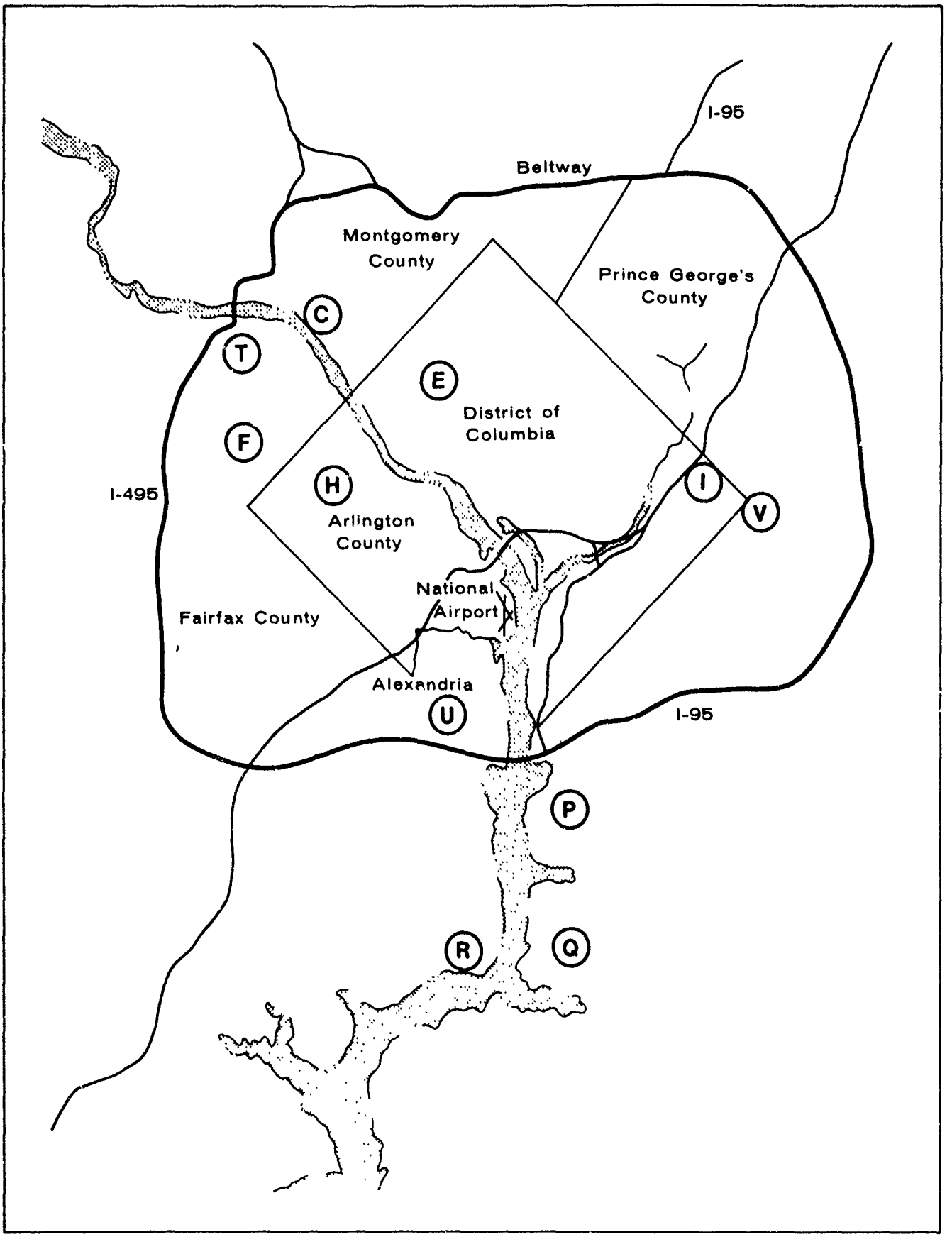
Eleven sites were chosen to conduct the interviews. The sites are listed in Table 2 and the general locations are shown in Figure 9. The sites were selected according to several criteria: 1) to include a variety of expected changes in noise exposure during the test, 2) proximity to permanent or temporary noise monitoring sites, 3) absence of high levels of non-aircraft noise, 4) suitability for telephone interviewing, and 5) to provide adequate geographic dispersion.

TABLE 2

INTERVIEW LOCATIONS

Site	Location
C	Glen Echo, MD
E	Cleveland Park, DC
F	McLean, VA
H	Northwest Arlington, VA
I	Kenilworth, DC
P	Oxon Hill, MD
Q	Tantallon, MD
R	Fort Hunt, VA
T	Langley, VA
U	Masonic Temple/South Alexandria, VA
V	Benning Road, DC/Seat Pleasant, MD

Source: Bolt Beranek and Newman Inc.



Location of Interview Sites

Figure 9

At each site, enough census tracts and blocks were identified to provide an adequate number of households for 200 telephone interviews during each of the four rounds of interviews. This sample size was selected to yield a 95 percent confidence interval no greater than +/- 7 percent for the central questions on annoyance. The census tracts and blocks used at each site are shown in BBN's report on the study, which is included at the back of this volume.

The questionnaire consisted of 11 questions. It is reproduced as Appendix B. Item 1 of the questionnaire was intended principally to verify that the party answering the telephone was an English-speaking household resident. Item 2 sought an overall indication of neighborhood satisfaction, an attitude potentially related to changes in aircraft noise exposure. Item 3, concerning annoyance due to street traffic noise, was included for calibration purposes. Item 4 sought a specific rating of neighborhood noisiness, without regard to noise source. The next three items addressed the issue of greatest interest, the prevalence of aircraft-noise-induced annoyance. In keeping with prior practice, the measure of annoyance was the percentage of respondents describing themselves as highly annoyed ("very" or "extremely" on a five-category scale that also included the categories "not at all", "slightly", and "moderately" annoyed). Annoyance was assessed for three time periods: the week (Item 5), month (Item 6), and year (Item 7) preceding each round of interviews. Item 8 asked how frequently aircraft overflights had been noticed during the past week. Item 9 was included to permit assessment of seasonal effects on reactions to aircraft noise exposure. Item 10 was included to provide a context for concerns about air traffic safety and aircraft noise exposure. The final item was included to provide evidence about activity interference due to aircraft noise exposure.

Training manuals were prepared to familiarize interviewers with the interview protocol, to define all terms, to aid in response scoring, and to provide other information to interviewers. Training sessions were held for several hours prior to each round of interviews. Telephone interviewing was conducted under central supervision from a single calling facility.

The four rounds of telephone interviews were conducted during the weekends of October 14-17, 1983 (before the test); November 11-14 and December 9-12, 1983 (during the test); and March 30-April 2, 1984 (after completion of the test). Calling began in mid-afternoon on Fridays and continued until an initial attempt and, if necessary, four follow-up calls (spaced at least three hours apart) had been made to each potential respondent. The same questions were asked during each round of interviews.

E. Public Response

1. Telephone

While not a scientific measure of community opinion, one means of expression of public response to the scatter plan was through special telephone lines installed to receive comments. The telephone numbers were publicized through local newspapers and citizen groups. For the first few

days of the test, some callers were unable to get through, but then additional phone lines were installed. The phone lines were open and staffed from 7:00 a.m. to 10:00 p.m. seven days a week. At other times, if MWA operations personnel were unable to answer the phone, a recording advised callers of the hours when the phone lines would be open. Each call was reported on a separate form, on which the location of the caller and the nature of the comment were noted. Each hour, the number of calls was tallied. At the end of the day, the calls were summarized, according to the number of calls for and against the scatter plan and the geographic origin of the calls.

2. Mail

MWA received letters commenting on the scatter plan. Each day, the letters received were sorted according to whether they expressed approval or disapproval of the test. Letters were also tallied by geographic origin and by whether they were form letters or individually written letters.

III. NOISE LEVEL DATA

A. Community Noise Levels

Noise impacts on a community are determined in two ways, measurement by on-site noise monitors and calculations using computer models. When noise levels are calculated, on-site measurements usually are also made to validate the computer model.

For the scatter plan test, a computer model was used to generate noise contours for Day-Night Noise Levels (Ldn) and for Time Above Threshold. Extensive on-site measurements also were made, both to validate the model and to provide data requested by the communities affected by the test.

1. Operational Data

The computer model used to calculate aircraft noise levels from data on aircraft operations is the Integrated Noise Model (INM) Version 3.8. The model includes file data on noise levels associated with different aircraft types, carrying different power settings, for different distances (slant-range) between noise source and observer. A limited comparison of measured data and file data was conducted to confirm the validity of using this file data for DCA departures and is discussed in Appendix D.

a. Aircraft Operations and Mix

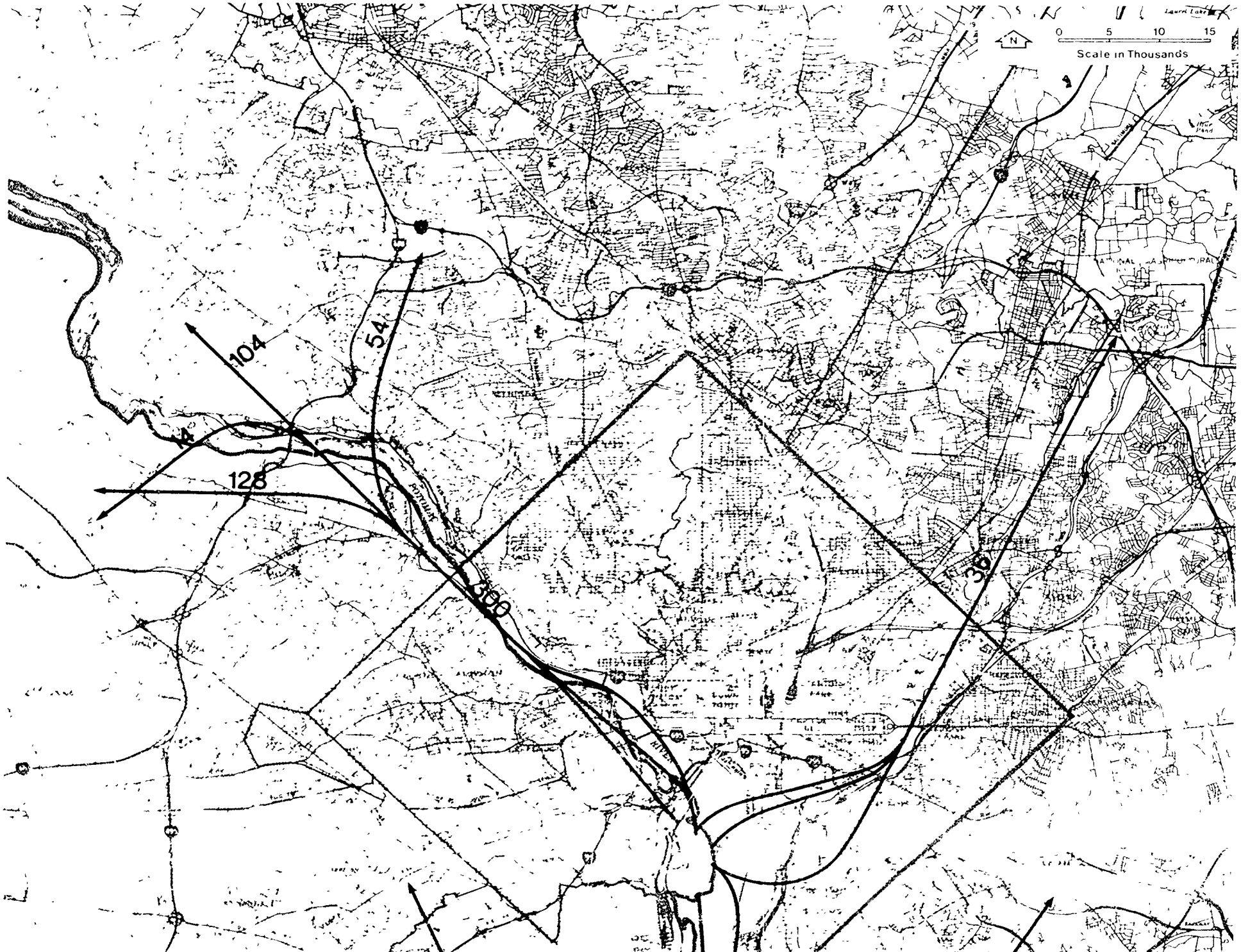
For an average day in October 1983, during the conduct of the test, there were 966 operations at Washington National Airport. Of these, 483 were departures, of which 304 were by turbojet aircraft following the test procedures.

The calculation of noise contours requires splitting up total operations by aircraft type and by time of day. This breakdown is provided in Table 3.

b. Aircraft Tracks

The allocation of the daily 304 turbojets to specific departure tracks for both non-test and test conditions is displayed in Figures 10 and 11. The flight tracks were developed through an analysis of several days' samples of radar plots for both northerly and southerly operational flows, with traffic assigned to each track based on the observed dispersal patterns in the radar plots. A total of 17 different turbojet departure tracks were identified to represent non-test conditions, and 41 tracks were identified to represent test conditions. The flight tracks in Figures 10 and 11 were developed for use in the computer model. They do not show actual flights but are intended to be representative of a typical day's departures. These tracks also include business jet operations, which are not included in the flight tracks shown in Chapter II.

The number on each of the tracks in Figure 10 indicates the number of jet departure overflights under non-test conditions, assuming a full day of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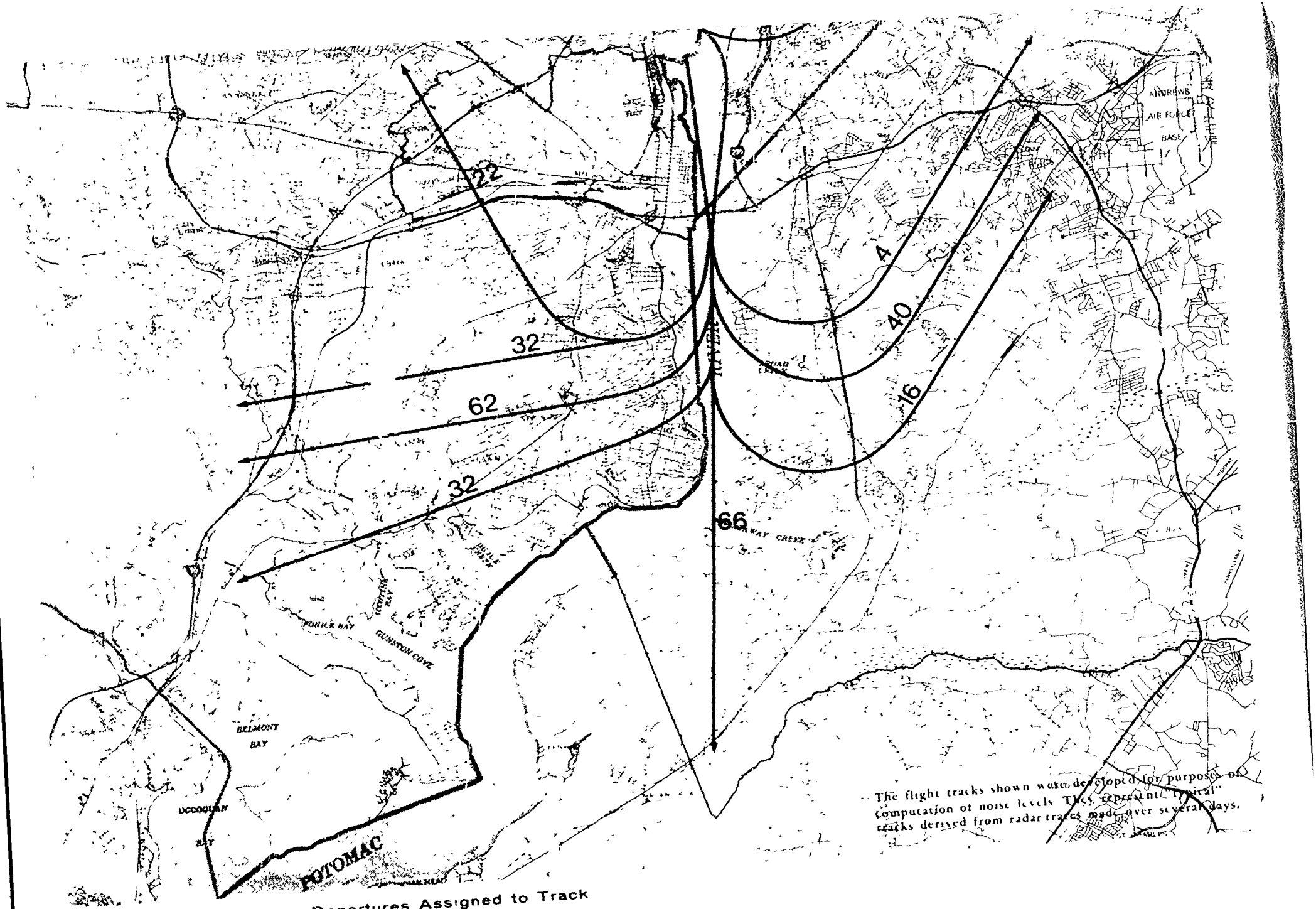
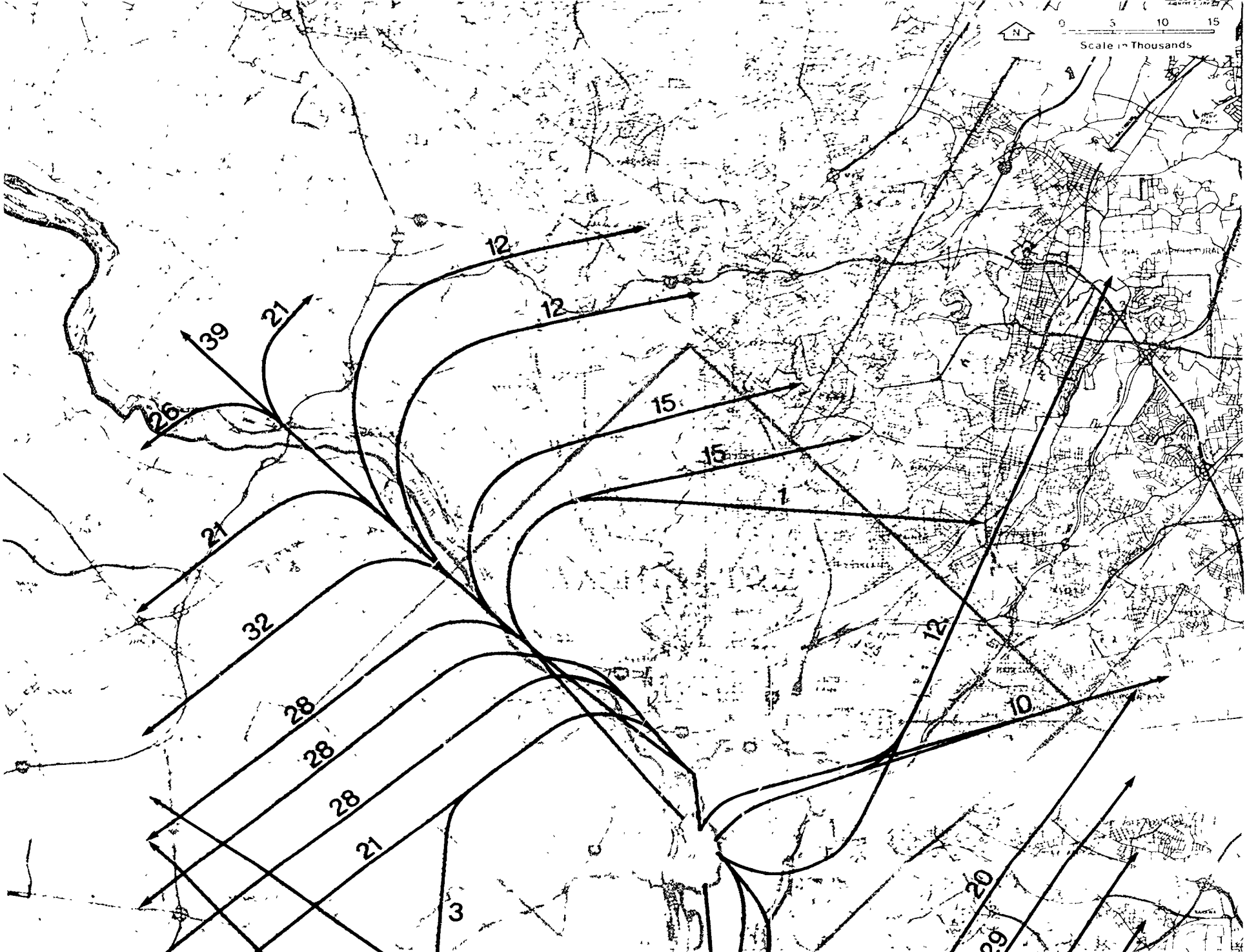

22
32
62
32
66
4
40
16
ANDREWS AIR FORCE BASE
POTOMAC
BELMONT BAY
GUNSTON COVE
PIMMIT RUN
HENSON CREEK
The flight tracks shown were developed for purposes of computation of noise levels. They represent "typical" tracks derived from radar traces made over several days.
Number of Daily Departures Assigned to Track
15
Track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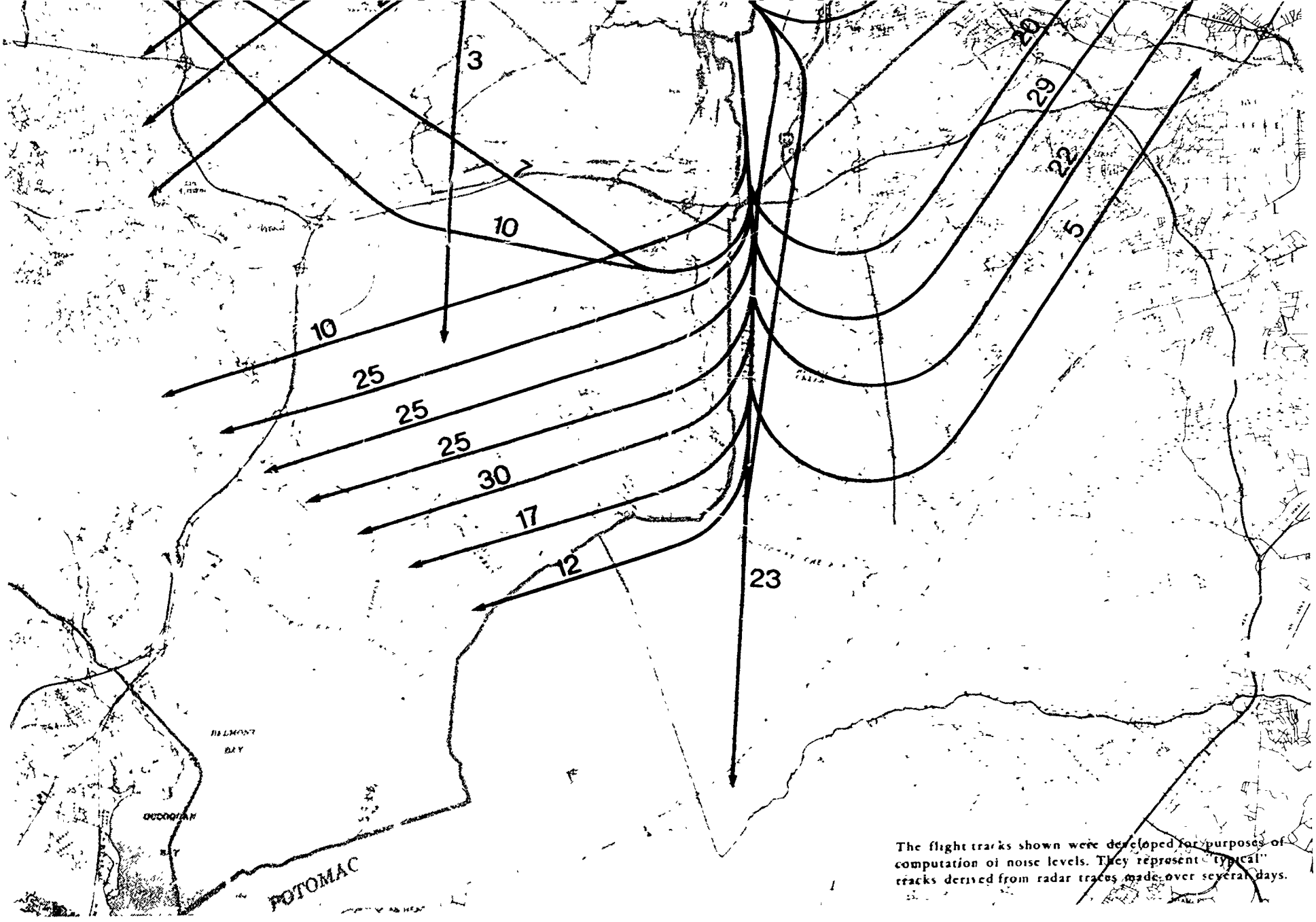


The flight tracks shown were developed for purposes of computation of noise levels. They represent "typical" tracks derived from radar traces made over several days.

15 — Number of Daily Departures Assigned to Track

Track

TABLE 3

AVERAGE DAILY DEPARTURES BY AIRCRAFT TYPE
(NON-TEST AND TEST CONDITIONS)

Aircraft Type	Departures Day (0700-2159)	Night (2200-0659)
TURBOJETS*		
727-100 (non Part 36)	21	0
727-200 (part 36)	105	0
737-100/200 (non Part 36)	16	0
737-100/200 (Part 36)	19	0
DC-9-30 (non Part 36)	38	0
DC-9-30 (Part 36)	29	0
DC-9-50 (Part 36)	11	0
MD-80 (DC-9-80) (Part 36)	11	0
757-200 (Part 36)	3	0
BAC-111 (non Part 36)	11	0
General Aviation Jets	40	0
PROPELLER AIRCRAFT**		
DeHavilland DHC-7	22	3
Shorts SD3-30	17	1
Beechcraft 99	65	5
Convair 580	5	1
Twin-Engine Piston	27	1
Single-Engine Piston	29	2
Total	466	17

*"Part 36" and "non Part 36" refers to the approximate number of aircraft operated in compliance with noise standards specified in Federal Aviation Regulations Part 36.

**Aircraft include the models listed plus those with the same general characteristics.

operations to either the north or south. The paths generally follow the rivers north and south of the airport. The tracks and numbers in Figure 11 show the average number of departures following a specific routing during the test. While there was some variation in tracks on a day-to-day basis, once controllers and pilots became familiar with the new procedures, the same general flight patterns were followed for the duration of the test. These tracks involved substantially greater overflight of residential areas close to the airport, primarily in Arlington County and Fairfax County.

The flight paths shown in both figures cover the general area where a typical turbojet transitions from ground elevation (at the airport) to approximately 7000 feet in altitude (at 70°F), above which the noise at ground level would be relatively insignificant. Beyond the paths shown, individual flight paths under both test and non-test conditions are widely scattered, as aircraft turn on course to various destinations.

c. Aircraft Profiles

Air carrier turbojet aircraft departing Washington National Airport during the pre-test and test period generally utilized one of two departure profiles -- the DCA procedure or the ATA procedure. The DCA procedure, specified for use by airport policy, consists of a climb to 1500 feet at takeoff power, then a reduction to a thrust necessary to maintain a 500 feet per minute (FPM) climb at maximum weight until 10 miles from the airport. At this point, normal climb power is applied.

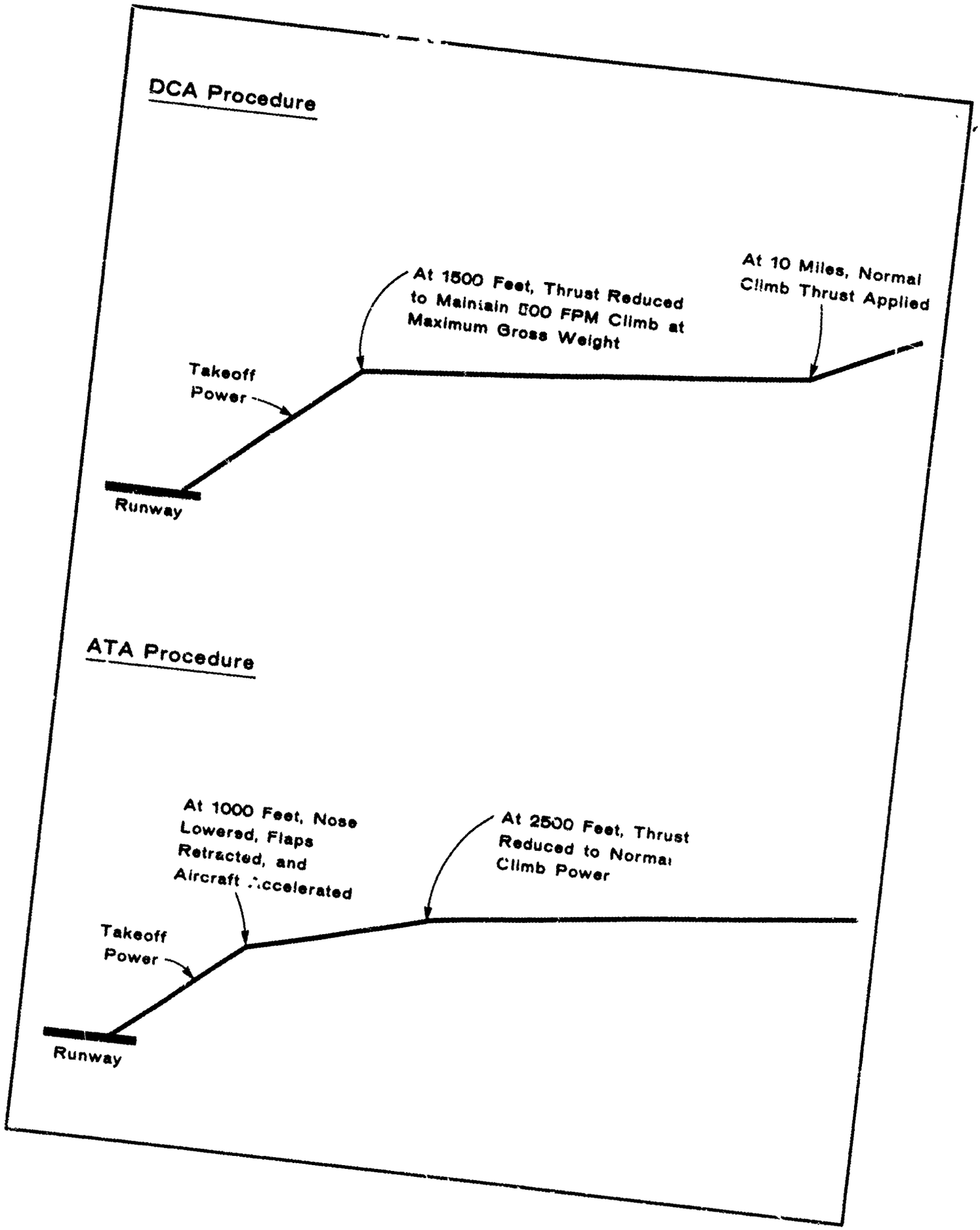
Under the ATA procedure, aircraft climb with takeoff power until they have "cleaned up" landing gear and flaps used for takeoff and have accelerated to an established speed. At this point, typically at 2500 feet, power is reduced to normal climb thrust. These profiles are included in the computer data base and are depicted graphically in Figure 12.

The profile of each aircraft takeoff will differ depending upon weight, weather conditions, aircraft type, and pilot technique. In fact, there was found to be a "spread" of profiles and thrust management procedures grouped about each of the specified profiles, the DCA procedure and the ATA procedure.

For the purpose of calculation of noise levels, departing turbojets were allocated to the two departure profiles based on the results of a 5-day sampling of flights during June 1983. During this sample period, the following pattern was observed.

B-727: 10% DCA procedure, 90% ATA procedure
B-737: 33% DCA procedure, 67% ATA procedure
DC-9: 22% DCA procedure, 78% ATA procedure

The percentages observed for DC-9 aircraft were used in the description of profiles for other air carrier jet aircraft not listed above. Business jets were assumed to fly the standard procedure established for them in the INM data base.



Comparison of Departure Profiles

Figure 12

2. Ldn Noise Levels

The most widely-recognized method of describing aircraft noise is the "Day-Night Sound Level" or Ldn. The Day-Night Sound Level was developed by the U.S. Environmental Protection Agency as a standard descriptor of community noise impacts from a variety of noise sources and has been adopted by the FAA and other agencies concerned with aircraft noise analysis. The index is recognized by the U.S. Department of Housing and Urban Development as a basis for land use planning around airports.

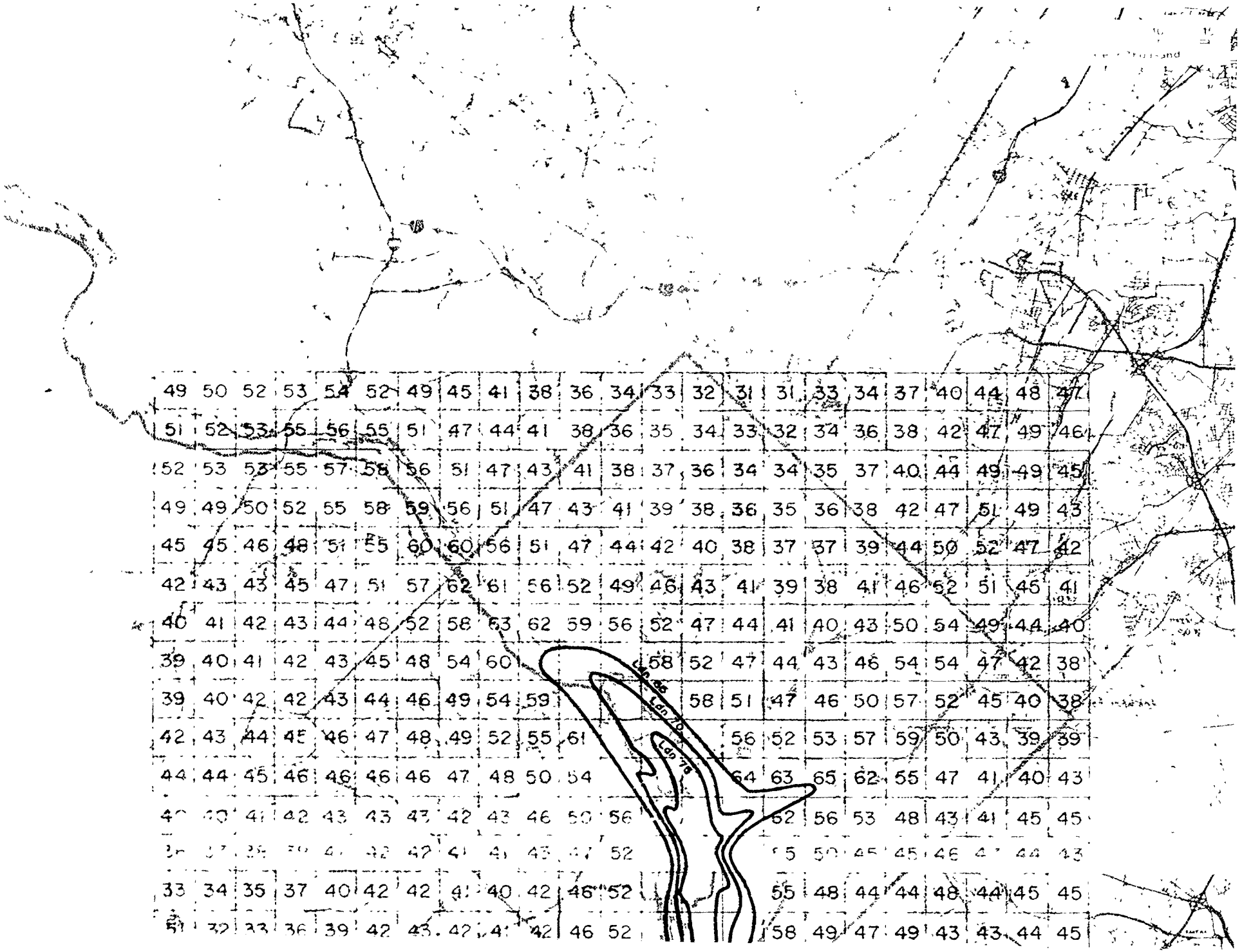
Ldn is a logarithmic average of sound levels in dBA. It is based upon a 24-hour Equivalent Sound Level (Leq) and is weighted to account for increased noise sensitivity at night, with a 10 dBA penalty applied to noise events between 10:00 p.m. and 7:00 a.m. The procedure for calculating Ldn takes into account flight paths, number of operations, and the flyover noise associated with a given aircraft. Contours are developed and mapped which reflect the noise of takeoffs and landings for an average day over a year's time.

The terms "65 dBA noise level" and "Ldn 65 noise level" are frequently confused to mean the same thing. They are in fact quite different. The first is an instantaneous measure of the magnitude of a noise event (such as that produced by an aircraft flying overhead), with frequencies weighted to approximate the sensitivity of human hearing. The dBA level will vary from moment to moment in response to the aircraft overflight and to other noise sources. The Ldn 65 is obtained by energy-averaging all of the noise levels over a 24-hour period (with a 10 dBA penalty for night noise); it is the continuous noise level that would be equivalent, on an energy basis, to the fluctuating noise signals expressed in dBA. The Ldn levels will be less than the maximum noise levels (expressed in dBA) experienced at any location within the specified 24-hour period.

The Ldn 65 and Ldn 70 contours for the non-test conditions are depicted in Figure 13. Also shown is a grid of Ldn values for areas outside of the Ldn 65 contour, that is, below Ldn 65. The Ldn 65 contour encompasses portions of Georgetown, Foggy Bottom, Potomac Park, Southwest DC, and Bolling Air Force Base as well as part of Old Town Alexandria, the Pentagon, part of Arlington National Cemetery, and the Rosslyn section of Arlington.

Figure 14 shows the noise contours for test conditions. These contours are similar to the contours for the non-test condition because turbojet departure paths close to the airport are the same for both test and non-test conditions. By the time the "scattering" of tracks occurred in the test, the Ldn levels had fallen to below Ldn 65. The grid values outside of the contours better reflect changes which resulted from the test, according to this index.

The Ldn contours and grid values only represent noise from aircraft arriving and departing Washington National Airport. At locations outside the Ldn 65 contour, noise from non-aircraft sources may be more significant than the aircraft Ldn values shown on Figures 13 and 14.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45 45 46 48 51 55 60 60 56 51 47 44 42 40 38 37 37 39 44 50 52 47 42
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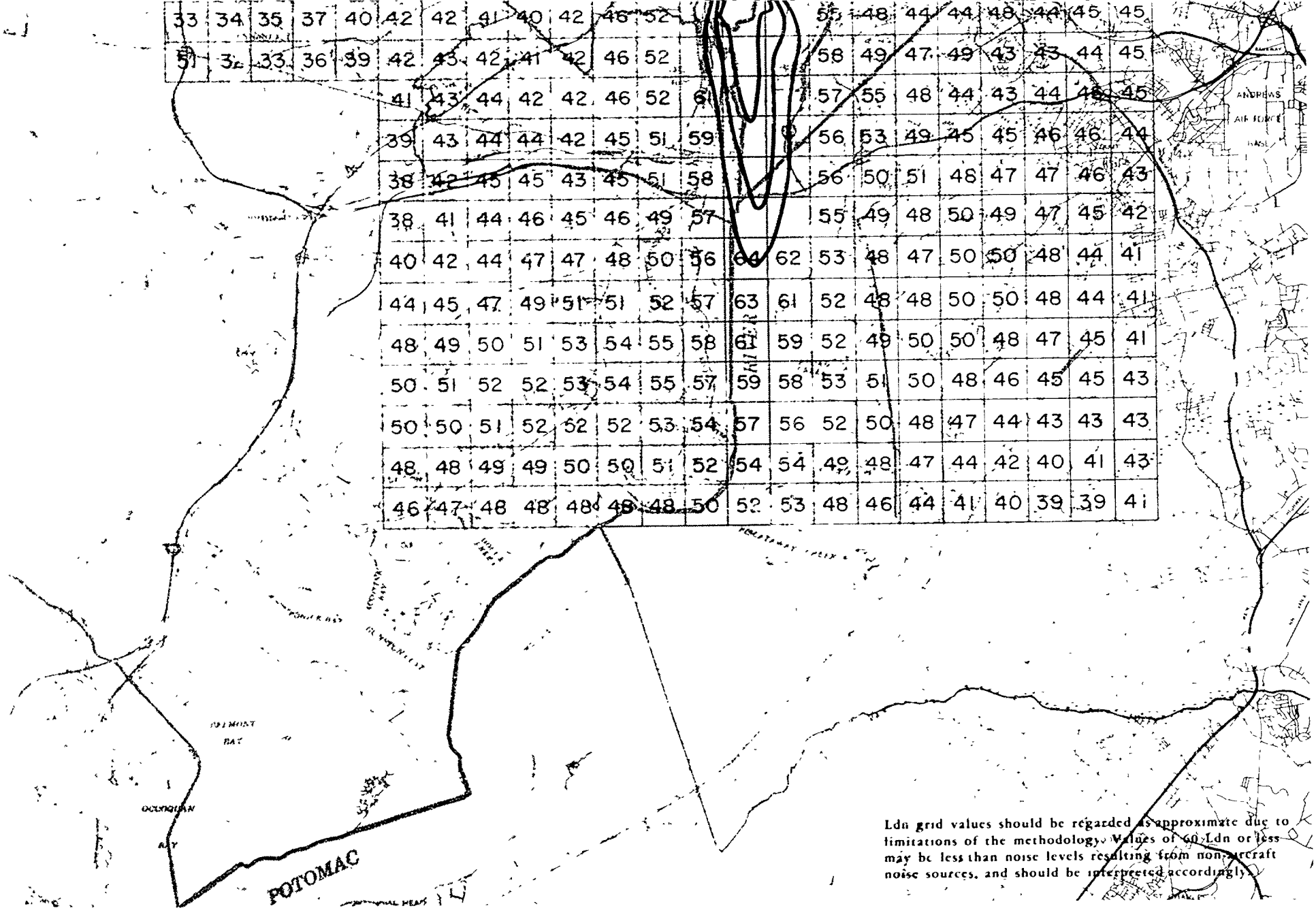
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ANDREWS AIR FORCE BASE
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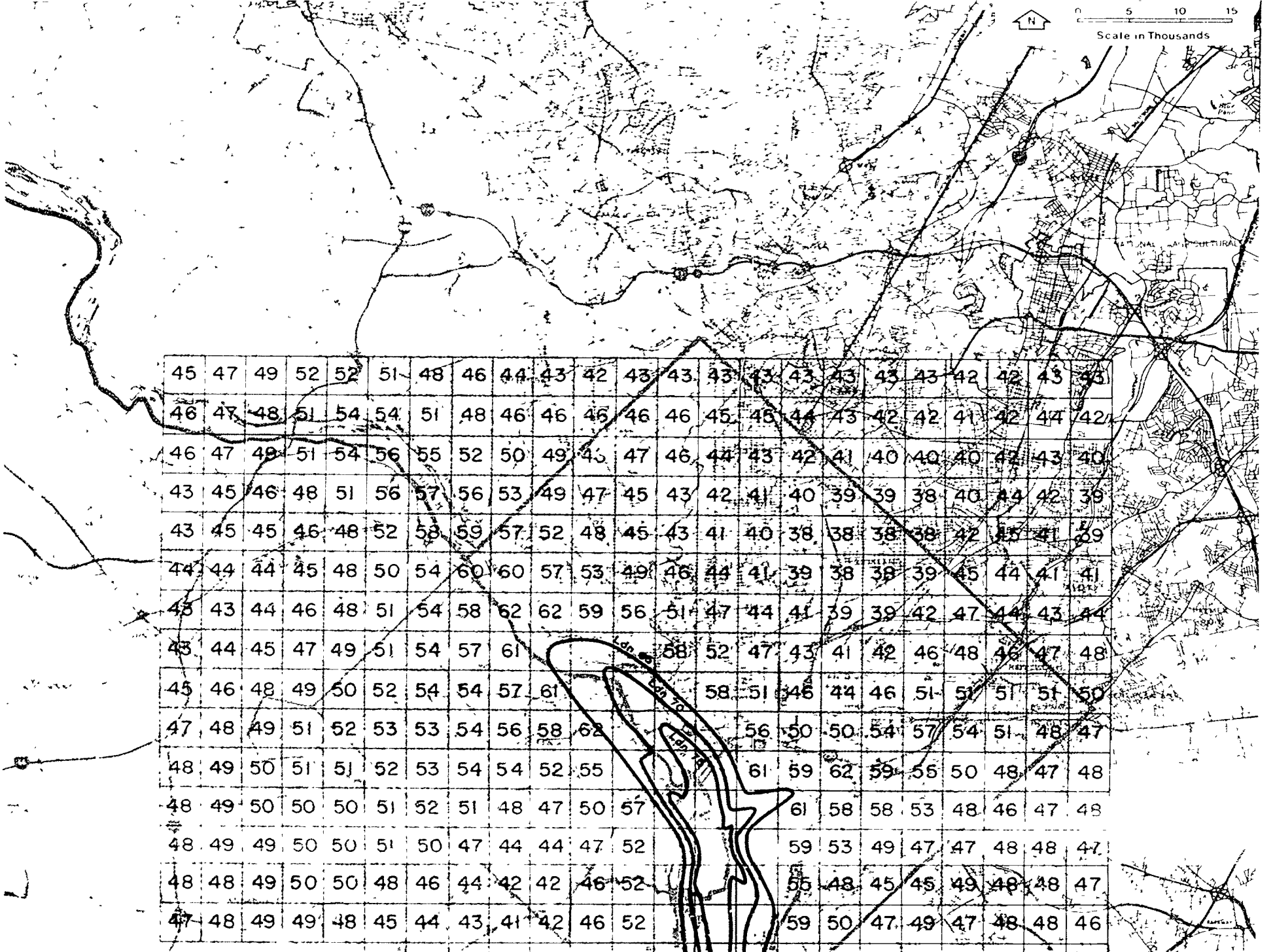
Ldn grid values should be regarded as approximate due to limitations of the methodology. Values of 60 Ldn or less may be less than noise levels resulting from non-aircraft noise sources, and should be interpreted accordingly.



45	47	49	52	52	51	48	46	44	43	42	43	43	43	43	43	43	43	43	42	42	43	43
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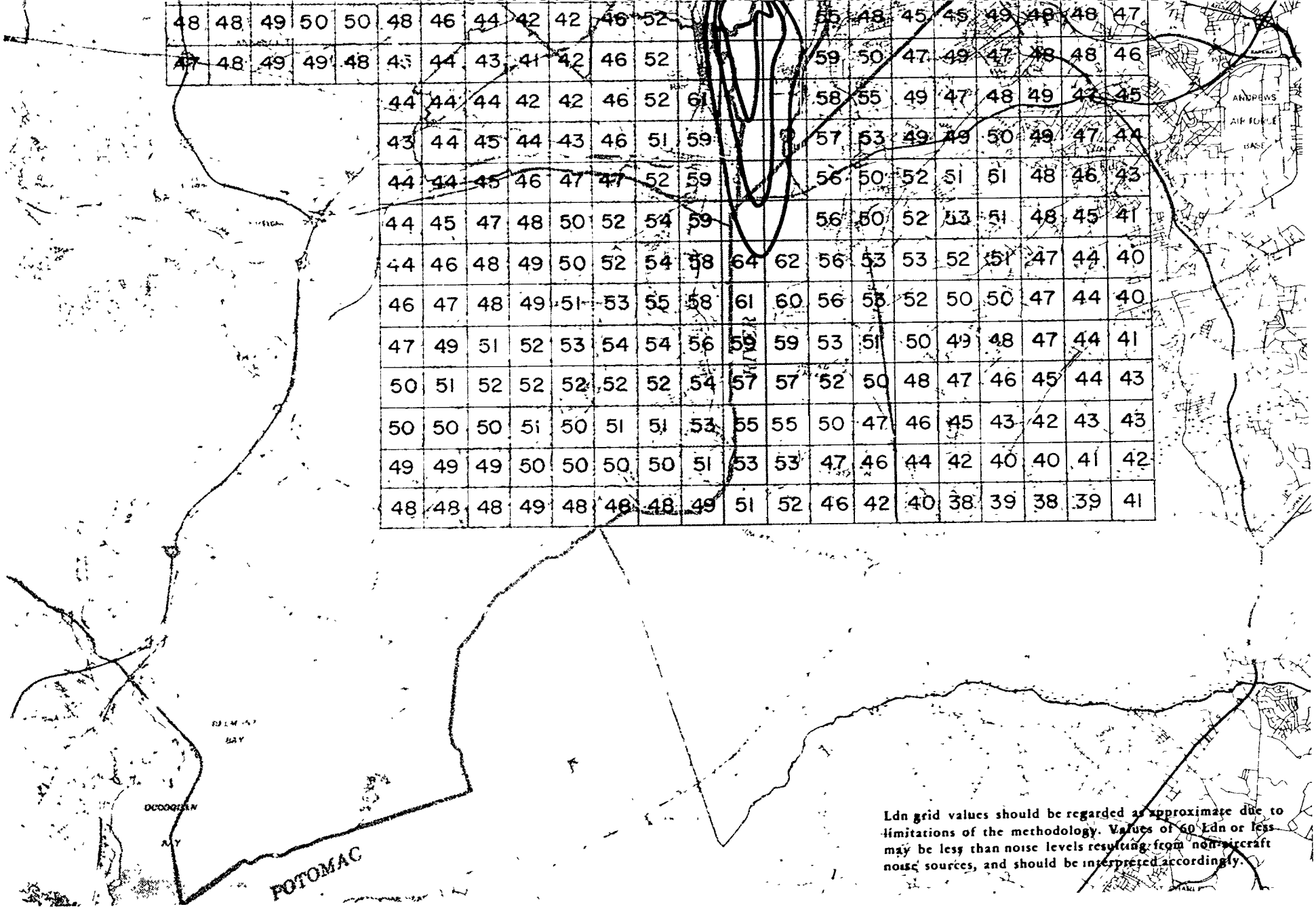

Ldn grid values should be regarded as approximate due to limitations of the methodology. Values of 60 Ldn or less may be less than noise levels resulting from non-aircraft noise sources, and should be interpreted accordingly.

A discussion of the relationship between measured Ldn data and calculated Ldn data is presented in Appendix D.

3. Time-Above-Threshold Contour

Time-Above-Threshold, the second indicator used to identify changes in noise impacts due to the scatter test, is the amount of time that areas experience aircraft-generated noise above a specified level in the course of an average day. The indicators chosen are the contours that enclose areas where aircraft noise reaches or exceeds 75 decibels for a total time of 30 seconds or more and five minutes or more per day. The 30-second, 75 decibel contour is the index used in the 1983 Environmental Assessment of the scatter plan.

The threshold level of 75 dBA was selected because it was high enough to be perceived by most people as aircraft noise and would not be masked by other noise sources. A higher level, on the other hand, would not have included many of the areas where changes in noise could be readily perceived during the test. The 30-second time interval was selected because it adequately defines the area subject to 75 dBA noise levels. The quality of data does not permit accurate identification of areas exposed for less than 30 seconds. The 5-minute time interval was selected in order to identify areas experiencing aircraft noise under the non-test conditions, but located outside the Ldn 65 contour, where the test could be expected to result in lower levels of aircraft noise.

Use of the 75 dBA contours does not mean that noise events of 75 decibels are not experienced outside the contours, or that noise levels higher than 75 dBA and exposure to longer average daily periods of 75 dBA do not occur inside the contours. Both higher levels and longer durations do occur inside the contours. The use of 75 dBA also does not imply that other noise levels are not significant or that 75 dBA is particularly disruptive.

Figure 15 shows the 30-second and 5-minute 75 dBA contours under non-test conditions. Generally, communities along the Potomac River as far north as Cabin John and as far south as Mount Vernon, and along the Anacostia River as far north as Bladensburg, are subject to these noise levels for 30 seconds or more per day.

Figure 16 depicts the 30-second and 5-minute 75 dBA contours for an average day's traffic for the scatter test. The 30-second contour is larger than the non-test contour and extends east into Chevy Chase (DC and Maryland) and, near the Anacostia River, extends into Seat Pleasant rather than Bladensburg. Also in Maryland, the contour extends into the Marlow Heights area. In Virginia, the test contour extends west to include most of Arlington County and Falls Church and a portion of Fairfax County in the Annandale area. The contour toward the south is nearly the same for both test and non-test conditions. The 5-minute contour does not show much difference between non-test and test conditions.

An attempt was made to compare the calculated Time Above data with measured field data. However, the noise monitors in the field did not measure Time Above directly, and there was not enough L0.1-L99 measured


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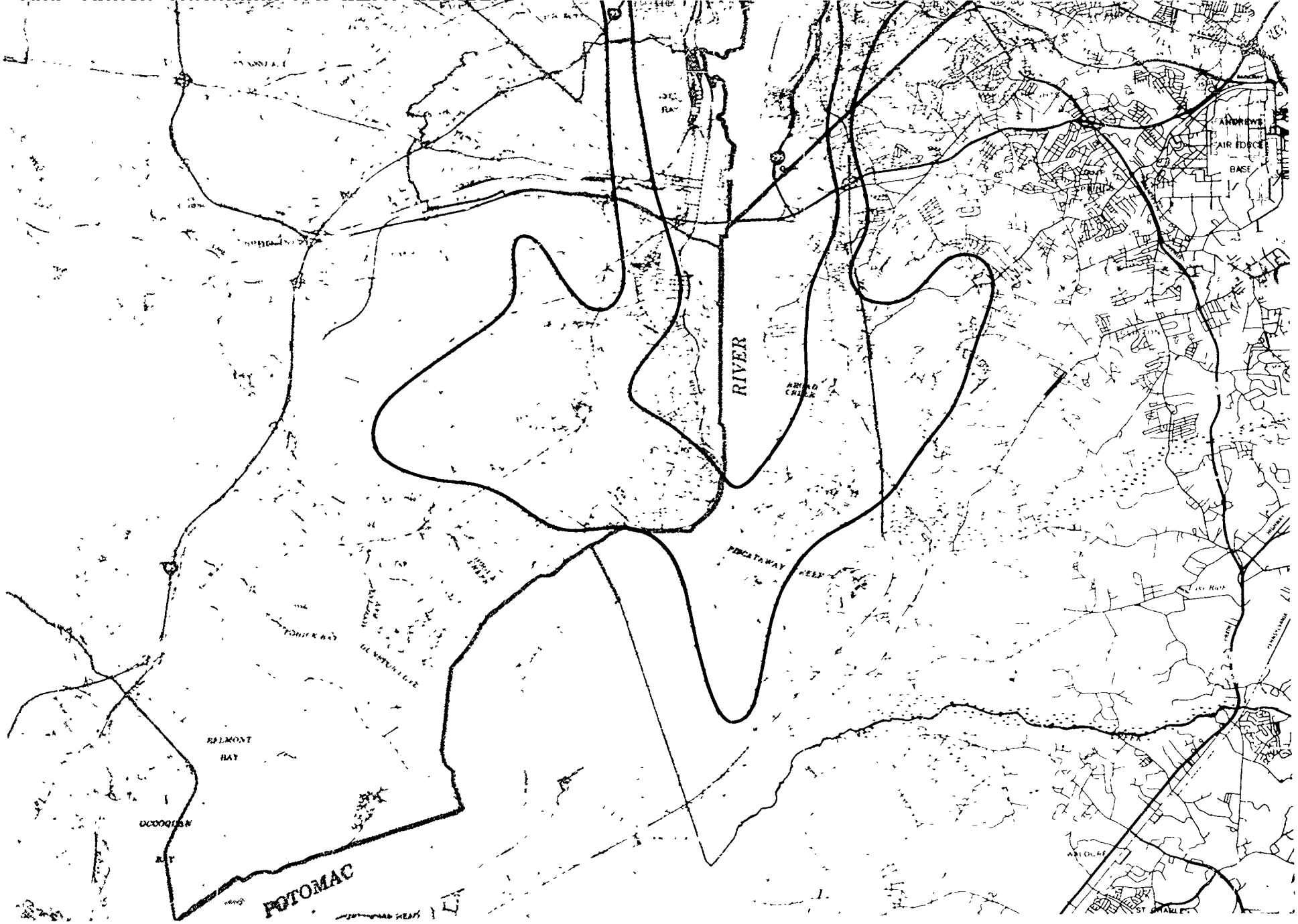
30 Minutes
30 Minutes



Time-Above-Threshold (75 dBA) Contours
Non-Test Conditions

Figure 15


0.5 Minutes
5.0 Minutes

Time-Above-Threshold (75 dBA) Contours
Test Conditions

Figure 16

data available to derive Time Above values. Therefore, no direct comparison of calculated vs. measured data was made. The inputs used to calculate the Time-Above noise contours were identical to the Ldn contour inputs, which are compared to measured data in Appendix D.

B. Changes in Population Affected

1. Population Within Ldn Contours

The populations residing within the Ldn 65 and Ldn 70 noise contours for both non-test and test conditions were estimated, and are shown in Table 4. Only the jurisdictions listed in Table 4 experienced changes in Ldn contours under test conditions, and no population resides within the Ldn 75 contour in either condition.

2. Population Within Time-Above-Threshold Contour

The population residing within the 30-second time-above-threshold contours for test and non-test conditions was estimated and is shown in Table 5. Noise levels decreased in some areas and increased in others, but, viewed on a jurisdictional basis, none of the area jurisdictions listed had a net decrease in population within the 30 second 75 dBA contour.

Population within the 5-minute time-above-threshold contours was not estimated, since the change between test and non-test conditions is small compared with the accuracy of the population estimates.

C. Changes in Noise Environment at Monitor Sites

1. Measured Data

a. Equivalent Sound Levels

The purpose of the monitoring program was to compare aircraft noise levels during the scatter test with aircraft noise levels during typical non-test periods. Table 6 shows the average hourly Equivalent Sound Level (Leq) for test and non-test periods for each of the 48 monitoring sites, for all observations. Table 7 shows the same comparison for weekday data only, Table 8 for weekend data only, and Table 9 for evening data only. Since weekend and evening data were not collected at all sites, Tables 8 and 9 do not list all the sites.

Changes in Leq at most locations were relatively small. For the weekday-only data, the change exceeded 3 decibels at 16 of the 48 monitoring locations. As a general rule of thumb, for a constant sound a difference of 10 dBA is perceived as a doubling of loudness. Since sound is measured on a logarithmic scale, a noise 3 dBA higher than another sounds about 20 percent louder, a just-noticeable difference.

TABLE 4

RESIDENTIAL POPULATION IN Ldn CONTOURS,
TEST AND NON-TEST CONDITIONS

Jurisdiction	Non-test		Test	
	Ldn 70	Ldn 65	Ldn 70	Ldn 65
District of Columbia	700	18,300	400	15,900
Arlington County	500	6,400	400	7,900
Alexandria	800	6,400	800	6,300
Total	2,000	31,100	1,600	30,100

Source: HNTB estimate.

TABLE 5

RESIDENTIAL POPULATION IN CONTOURS OF
30-SECOND TIME ABOVE 75 dB,
TEST AND NON-TEST CONDITIONS

Jurisdiction	Non-test	Test	Net Increase For Test
District of Columbia	343,000	433,000	90,000
Arlington County	68,000	121,000	53,000
Alexandria	48,000	48,000	0
Falls Church	0	9,000	9,000
Fairfax County	85,000	163,000	78,000
Prince Georges County	44,000	79,000	35,000
Montgomery County	18,000	30,000	12,000
Total	606,000	883,000	277,000

Source: HNTB estimate.

TABLE 6

AVERAGE MEASURED HOURLY Leq, ALL OBSERVATIONS,
NON-TEST AND TEST

Site	Non-test	Test	Change	Site	Non-test	Test	Change
11	60.2	57.9	-2.3	SC	61.1	60.9	-0.2
12	64.3	59.8	-4.5	SD	58.3	61.8	+3.5
13	68.0	65.0	-3.0	SE	59.9	59.1	-0.8
14	68.1	64.8	-3.3	SF	54.4	53.7	-0.7
15	71.2	70.0	-1.2	NR2	58.6	60.1	+1.5
16	66.1	65.3	-4.8	NR3	53.6	53.6	0
17	70.1	68.3	-1.8	NR4	66.2	66.0	-0.2
18	67.3	67.2	-0.1	SR1	57.6	57.9	+0.3
19	72.7	73.0	+0.3	FN1	54.5	58.9	+4.4
20	69.0	67.8	-1.2	FN2	54.2	61.0	+6.8
21	62.5	63.1	+0.6	FN4	52.6	57.6	+5.0
22	60.8	59.9	-0.9	FN5	53.9	54.4	+0.5
23	62.0	61.6	-0.4	FN6	57.9	57.6	-0.3
24	61.6	57.1	-4.5	FN7	52.2	57.2	+5.0
3	59.3	61.5	+2.2	FN8	54.1	60.3	+6.2
NA	53.7	54.8	+1.1	FN9	54.2	57.8	+3.6
NB	55.3	57.8	+2.5	FS1	55.0	54.3	-0.7
NC	63.5	64.4	+0.9	FS2	58.6	61.3	+2.7
ND	53.3	56.6	+3.3	FS3	60.1	59.0	-1.1
NE	54.6	57.6	+4.3	A1	59.3	63.7	+4.4
NF	57.0	61.5	+4.5	A2	55.0	60.6	+5.6
NG	54.2	57.8	+3.6	A3	59.1	61.2	+2.1
SA	56.9	58.0	+1.1	A4	59.1	58.2	-0.9
SB	56.5	57.1	+0.5	TP1	54.5	55.0	+0.5

Source: HNTB and FAA Field Observations.

TABLE 7

AVERAGE MEASURED HOURLY Leq, WEEKDAYS ONLY, NON-TEST AND TEST

Site	Non-test	Test	Change	Site	Non-test	Test	Change
11	60.5	57.9	-2.6	SC	61.9	61.4	-0.5
12	64.3	59.6	-4.7	SD	58.3	62.4	+4.1
13	68.2	64.8	-3.4	SE	60.8	59.0	+1.8
14	68.2	64.5	-3.7	SF	54.7	56.9	+2.2
15	71.8	69.9	-1.9	NR2	57.8	60.1	+2.3
16	66.3	65.1	-1.2	NR3	54.3	53.6	+1.3
17	70.1	68.3	-1.8	NR4	66.2	66.0	-0.2
18	67.7	67.7	0	SR1	57.6	57.9	+0.3
19	73.4	72.9	-0.5	FN1	54.5	58.9	+4.4
20	69.3	67.8	-1.5	FN2	54.2	61.0	+6.8
21	61.6	63.3	+1.7	FN4	52.1	57.6	+5.5
22	61.0	59.9	-1.1	FN5	53.9	54.4	+0.5
23	62.4	61.7	-0.7	FN6	57.4	57.6	+0.2
24	61.2	56.8	-4.4	FN7	52.2	57.2	+5.0
3	59.7	61.7	2	FN8	54.1	60.3	+6.2
NA	53.5	54.7	+1.2	FN9	54.2	57.8	+3.6
NB	54.9	57.5	+2.6	FS1	55.0	54.3	-0.7
NC	63.5	64.4	+0.9	FS2	58.6	61.3	+2.7
ND	54.2	58.8	+4.6	FS3	60.8	59.0	-1.8
NE	55.0	57.1	+2.1	A1	59.3	63.7	+4.4
NF	57.3	61.7	+4.4	A2	55.0	60.6	+5.6
NG	53.4	57.5	+3.1	A3	59.1	61.2	+2.1
SA	56.9	58.6	+1.7	A4	59.1	58.2	-0.9
SB	56.2	57.6	+1.4	TP1	54.5	55.0	+0.5

Source: HNTB and FAA Field Observations.

TABLE 8

AVERAGE MEASURED HOURLY LEQ, WEEKENDS ONLY, NON-TEST AND TEST

Site	Non-test	Test	Change
NA	53.8	55.0	+1.2
NB	57.0	53.5	+1.5
ND	*	57.0	-
NE	52.8	59.5	+6.7
NF	56.8	60.6	+3.8
NG	55.8	58.7	+2.9
SA	55.0	54.3	-0.7
SB	56.8	55.3	-1.5
SC	57.3	58.5	+1.2
SD	58.3	59.0	+0.7
SE	57.3	60.8	+3.5
SF	52.5	56.3	+3.8
3	58.2	60.7	+2.5
11	58.1	58.2	+0.1
12	64.4	57.7	-6.7
13	66.6	62.8	-3.8
14	67.5	62.5	-5.0
15	69.8	68.0	-1.8
16	65.1	64.7	-0.4
17	70.7	66.7	-4.0
18	66.2	65.2	-1.0
19	70.7	73.1	+2.4
20	68.3	67.8	-0.5
21	65.2	62.5	-2.7
22	60.3	59.8	-0.5
23	60.8	61.2	+0.9
24	63.6	55.8	-7.8

*data not available.

Source: HNTB and FAA Field Observations.

TABLE 9

AVERAGE MEASURED HOURLY LEQ, EVENINGS ONLY, NON-TEST AND TEST

Site	Non-test	Test	Change
NA	55.5	*	-
NB	55.7	58.0	+0.3
NE	*	58.7	-
NF	55.3	61.0	+5.7
SA	58.3	58.3	0
SB	59.0	53.7	-5.3
SC	*	61.0	-
SD	59.0	61.3	+2.3
SE	59.0	57.3	-1.7
SF	*	49.3	-

*data not available.

Source: HNTB and FAA Field Observations.

b. Maximum Sound Levels

For the temporary and mobile sites, the average hourly maximum sound level was determined and is listed in Table 10.

c. Ambient (Non-Aircraft) Noise

In order to identify the contribution of non-aircraft noise to the total noise measured at the monitoring sites, data on ambient noise levels was compiled. These data were collected in two forms: daily non-aircraft Leq's calculated for the permanent monitoring sites, and hourly Leq's measured at temporary sites during the non-test monitoring program at times when the sites were clearly not being overflown by aircraft at low altitudes. Ambient noise levels are shown in Table 11. While these data provide general information on ambient levels in different neighborhoods, they should not be considered a precise representation of non-aircraft noise, since the complete removal of aircraft noise sources (from high altitude or distant flights) during the monitoring program would have been impossible.

2. Analysis of Field Observation Data

For all temporary and mobile monitoring sites, the field staff recorded data on the number of aircraft noise events and the maximum sound level of each aircraft noise event. Using a sample of these data, an analysis of these monitored levels was made. This provides an additional dimension to the noise experience at each site, under test and non-test conditions. The sampling consisted of two weekday morning hours and two weekday afternoon hours for each site. When available, pre-test data were used for the non-test analysis; otherwise post-test data were used. Events identified by the field staff as helicopter flyovers were not included. Table 12 summarizes the analysis of these sample hours.

TABLE 10

MEASURED AVERAGE HOURLY Lmax

Site	Non-test	Test	Change	Site	Non-test	Test	Change
NA	69.5	71.1	+1.6	SR1	72.3	72.4	+0.1
NB	69.6	74.9	+5.3	FN1	68.8	77.1	+8.3
NC	70.6	72.8	+2.2	FN2	70.6	80.5	+9.9
ND	70.6	72.8	+2.2	FN4	70.2	75.9	+5.7
NE	68.4	75.8	+7.4	FN5	72.0	71.8	-0.2
NF	72.6	80.9	+8.3	FN6	74.3	75.9	+1.6
NG	71.8	77.2	+5.4	FN7	69.2	78.2	+9.0
SA	71.6	72.9	+1.3	FN8	74.9	78.2	+3.3
SB	71.5	74.4	+2.9	FN9	72.2	77.2	+5.0
SC	78.2	78.4	+0.2	FS1	75.0	71.4	-3.6
SD	73.7	79.0	+5.3	FS2	76.6	80.1	+3.5
SE	80.1	78.8	-1.3	FS3	81.1	75.0	-6.1
SF	73.1	73.3	+0.2	A1	77.0	83.2	+6.2
NR2	76.6	77.7	+1.1	A2	71.0	79.6	+8.6
NR3	76.6	69.5	-7.1	A3	74.9	79.7	+4.8
NR4	84.0	83.8	-0.2	A4	76.6	76.2	-0.4
				TP1	66.6	70.2	+3.6

Source: HNTB and FAA Field Observations.

TABLE 11

TYPICAL AMBIENT (NON-AIRCRAFT) NOISE LEVELS

Site	Daily Leq	Site	Daily Leq
11	54.4	NA	53.7
12	55.7	ND	55.3
13	57.1	NF	57.0
14	57.0	NG	54.2
15	58.4	NR2	58.6
16	58.1	NR3	53.6
17	65.4	A2	55.0
18	61.9	TP1	54.5
19	60.7	FN1	54.5
20	58.0	FN2	54.2
21	54.8	FN4	52.6
22	54.8	FN5	53.9
23	53.8	FN8	54.1
		FN9	54.2

Source: HNTB and FAA Field Observations.

TABLE 12

MONITORED LEVELS OF AIRCRAFT NOISE EVENTS FOR SAMPLE HOURS (dBA)

Site	Non-test			Test		
	No. of aircraft noise events/hr.	Avg. max level	Loudest aircraft noise	No. of aircraft noise events/hr.	Avg. max level	Loudest aircraft noise
NA	8	61	75	6	62	74
NB	16	61	70	25	65	84
NC	12	69	81	14	69	88
ND	1	71	82	8	59	72
NE	11	60	70	15	64	77
NF	19	62	74	22	70	92
NG	6	65	74	9	66	79
SA	2	68	73	2	68	77
SB	28	61	72	23	63	89
SC	11	70	81	15	69	81
SD	7	66	73	9	64	81
SE	20	63	87	18	63	87
SF	8	66	78	8	65	77
NR2	4	63	68	8	73	84
NR3	5	57	67	10	59	69
NR4	14	73	82	23	75	91
SR1	20	64	74	16	63	75
FN1	1	65	66	10	65	75
FN2	7	59	70	13	68	81
FN4	8	61	73	11	66	77
FN5	5	64	75	6	65	77
FN6	17	59	73	17	62	82
FN7	7	61	70	9	68	83
FN8	6	67	80	11	66	86
FN9	6	64	74	13	65	84
FS1	8	64	76	10	64	76
FS2	11	62	82	14	66	83
FS3	12	68	79	14	63	74
A1	12	67	77	18	73	87
A2	18	57	78	5	74	82
A3	10	66	71	17	67	90
A4	21	67	76	24	65	76
TP1	4	60	70	3	69	74

Source: HNTB analysis of HNTB and FAA Field Observations.

IV. COMMUNITY ATTITUDINAL DATA

A. Attitudinal Survey

This section presents a summary of the data obtained in the COG's attitudinal survey and a comparison of community attitudinal data with changes in noise levels. A more detailed presentation of the survey results is contained in a separate report[1] which is presented in its entirety at the back of this volume.

1. Survey Data

Interviewing was undertaken at all eleven sites during Rounds 1 to 3. During Round 4, no interviewing was done at the two sites (I, Kenilworth, DC, and V, Benning Road, DC) where changes in annoyance were smallest during the preceding three rounds. The total number of interviews completed during all four rounds was 9,783 (2,526 in Round 1, 2,631 in Round 2, 2,667 in Round 3, and 1,959 in Round 4).

For all questionnaire items except Item 1, respondents were asked to indicate the intensity of their opinion by selecting the one term that best described their viewpoint. For example, questions regarding annoyance required respondents to select one of five categories of annoyance (not-at-all, slightly, moderately, very, and extremely). Responses to questions regarding annoyance were summarized by the proportion of respondents who selected either of the two most intense category scale ratings (very or extremely). These respondents were considered to be highly annoyed by aircraft noise.

In response to Item 1 of the questionnaire, about 86 percent of the respondents reported residency greater than two years, a period of time more than adequate to develop meaningful impressions of the effects of aircraft noise exposure in a neighborhood.

Item 2 rated neighborhood satisfaction. Although neighborhood satisfaction varied from one interview site to another, no large differences were observed at any particular site between single interview rounds and the averages across all four rounds.

Item 3 measured annoyance due to traffic noise. Not surprisingly, significant differences among neighborhoods were observed. This outcome is most likely a consequence of differences in street traffic associated with the range in population densities and numbers of thoroughfares within site boundaries. The magnitudes of the observed differences among rounds are not large enough at any site to attain statistical significance.

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[1] Attitudinal Survey of Test to Amend Departure Paths at Washington National Airport, Bolt Beranek and Newman Inc., September 1984.

Item 4 asked respondents to rate their neighborhoods as noisy or quiet. Once again, no significant differences among rounds within any one site were observed.

Items 5, 6 and 7 covered the central questions of aircraft noise annoyance. The percentages of respondents at each site describing themselves as highly annoyed by aircraft noise are presented in Table 13 for the week, month and year prior to each round of interviews at each site.

The most direct evidence of scatter plan effects is contained in responses to questionnaire Items 5 and 6 (noise annoyance during the past week and past month). Analyses of both Item 5 and Item 6 lead to near identical conclusions regarding proportions of the population highly annoyed. Table 14 indicates interview sites where significant differences may be found between the average of Rounds 1 and 4 (before and after the test) and the average of Rounds 2 and 3 (during the test). The largest increase in annoyance during Rounds 2 and 3 occurred at Site H (North Arlington, VA), while the largest decrease occurred at Site C (Glen Echo, MD).

By and large, the patterns observed in the aircraft annoyance questions (Item 5 and 6) are repeated in Item 8, frequency of notice of aircraft. Sites F (McLean, VA) and H (Northwest Arlington, VA), where annoyance increased during Rounds 2 and 3, also has respondents noticing more aircraft in the week prior to these two rounds. Responses for Round 1 on this question were quite consistent across sites. Between 70 and 80 percent of the population indicated no change, while the remainder of the respondents were fairly evenly divided between noticing more and fewer aircraft. These results suggest that respondents believed aircraft activity prior to Round 1 was representative of the preceding year as a whole.

A seasonal trend is shown by Item 9. The percentage of respondents reporting windows generally shut rose from approximately 60 percent in Round 1 to 90 percent in all subsequent rounds.

Item 10 revealed the priority of concern with aircraft noise and safety (ranked by percentages of respondents very or extremely concerned) at each site for each round of interviews. Site H (Northwest Arlington, VA) is the only site where a consistent and significant change between rounds was observed, with more concern over aircraft noise expressed in Rounds 2 and 3, during the test. This site also exhibited the most dramatic change in of annoyance between Rounds 1 and 4 and Rounds 2 and 3.

Item 11 asked how often aircraft noise interfered with radio/TV listening, with conversation, or with rest and relaxation in the week prior to each round of interviews. Interference with radio and television listening was most frequently cited as "often", followed by interference with rest and relaxation. Site H (North Arlington, VA) exhibited the greatest increase between Round 1 and subsequent rounds. This trend is consistent with the responses from this site for Items 5 and 6 (aircraft noise annoyance), Item 8 (notice of greater number of aircraft), and Item 10 (aircraft noise as neighborhood concern).

TABLE 13

RESPONSE TO SURVEY QUESTIONS ON AIRCRAFT NOISE ANNOYANCE

Site	Interview Round	Percent "Highly Annoyed" Previous Week	Previous Month	Previous Year
C - Glen Echo, MD	1	19	18	22
	2	13	15	24
	3	15	15	28
	4	29	26	28
E - Cleveland Park, DC	1	4	5	1
	2	5	4	1
	3	3	4	1
	4	3	3	3
F - McLean, VA	1	4	2	2
	2	12	10	3
	3	12	12	4
	4	5	*	9
H - Northwest Arlington, VA	1	5	4	3
	2	29	23	4
	3	29	28	5
	4	8	9	23
I - Kenilworth, DC	1	3	4	3
	2	6	3	4
	3	3	4	6
P - Oxon Hill, MD	1	7	3	7
	2	6	2	5
	3	9	6	9
	4	6	4	8
Q - Tantallon, MD	1	6	8	7
	2	6	8	12
	3	12	10	12
	4	6	6	10
R - Fort Hunt, VA	1	15	18	16
	2	12	13	19
	3	10	10	20
	4	12	10	22
T - Langley, VA	1	14	15	18
	2	6	10	16
	3	8	8	17
	4	13	13	15
U - Masonic Temple/ S. Alexandria, VA	1	8	9	8
	2	13	10	6
	3	10	10	5
	4	9	8	11
V - Benning Road, DC/ Seat Pleasant, MD	1	4	4	5
	2	4	3	2
	3	4	3	3

*Less than 0.5%.

Source: Bolt Beranek and Newman Inc.

TABLE 14

SIGNIFICANT DIFFERENCES BETWEEN PERCENT HIGHLY ANNOYED BY AIRCRAFT NOISE NON-TEST (ROUNDS 1 AND 4) VS. TEST (ROUNDS 2 AND 3)

Site	Annoyance Difference
C - Glen Echo, MD	Test less than Non-Test
E - Cleveland Park, DC	None
F - McLean, VA	Test greater than Non-Test
H - Northwest Arlington, VA	Test greater than Non-Test
I - Kenilworth, DC	None
P - Oxon Hill, Md	None
Q - Tantallon, MD	None
R - Fort Hunt, VA	None
T - Langley, VA	Test less than Non-Test
U - Masonic Temple/ S. Alexandria, VA	None
V - Benning Road, DC/ Seat Pleasant, MD	None

Source: Bolt Beranek and Newman Inc.

2. Correlation with Noise Level Data

Table 15 presents survey responses on aircraft noise annoyance for each interview site along with the change in the calculated Ldn noise level experienced during the scatter plan test at each site. The "percent highly annoyed" is the response to Item 6 of the survey, referring to annoyance during the month before the questioning. The "Non-Test" percent represents the average of those responding as very or extremely annoyed during interview Rounds 1 and 4. "Test" is an average for Rounds 2 and 3.

The Ldn values were calculated using the Integrated Noise Model. The Ldn values shown in the table are approximate, since each interview site covered a fairly large geographic area.

Site H, Northwest Arlington, VA, had the greatest increase in residents highly annoyed by aircraft noise during the test. This site also had a large increase in calculated Ldn level during the test. The only sites where the change in annoyance during the test did not correspond to the change in Ldn were Site C, with a significant increase in annoyance but almost no change in Ldn, and Site V, which had no significant change in annoyance but a 9-unit increase in the Ldn level. The noise measurement sites nearest to interview Site C were Sites 11 and 24. The average measured hourly Leq at both these locations (Table 6) decreased by 4.5 decibels, among the largest decreases measured during the test. At Site V, even with a relatively large increase in Ldn, the Test Ldn value of 48 is still quite low and not objectional to most people.

B. Public Response

The scatter plan test was well publicized in area news media, and the public was given an opportunity to comment on the test by means of a special telephone line or by writing to MWA.

1. Telephone

During the test, nearly 18,000 telephone calls were received expressing an opinion on the scatter plan. The calls do not represent a scientific measure of public opinion, but the number of calls for and against the plan from each community were tallied as a matter of information. Twenty-five percent of the calls during the test were in favor of the scatter plan and 75 percent opposed it. Table 16 presents a tabulation of calls for and against the plan from each community. (The communities listed in Table 16 are taken from the telephone complaint form used by the phone operators to record comments.)

By far the largest number of calls came from Arlington, where 91 percent of the callers opposed the scatter plan. Other communities with large numbers of callers opposing the plan included Falls Church, Northwest Washington, Annandale, Chevy Chase and Fairfax. Support for the plan came from callers in Bethesda, Alexandria, Potomac, Cabin John and Fort Washington. Callers from McLean were fairly evenly divided.

TABLE 15

COMPARISON OF ATTITUDINAL DATA WITH NOISE LEVEL DATA

Interview Site	Percent "Highly Annoyed"			Ldn Noise Level		
	Non-Test	Test	Change	Non-Test	Test	Change
C - Glen Echo, MD	22	15	-7	56	55	-1
E - Cleveland Park, DC	4	4	0	48	49	+1
F - McLean, VA	1	11	+10	43	47	+4
H - Northwest Arlington, VA	7	26	+19	46	54	+8
I - Kenilworth, DC	4	4	0	47	46	-1
P - Oxon Hill, Md	4	4	0	52	54	+2
Q - Tantallon, MD	7	9	+2	49	47	-2
R - Fort Hunt, VA	14	12	-2	53	52	-1
T - Langley, VA	14	9	-5	53	49	-4
U - Masonic Temple/ S. Alexandria, VA	9	10	+1	47	47	0
V - Benning Road, DC/ Seat Pleasant, MD	4	3	-1	39	48	+9

Source: Bolt Beranek and Newman Inc. and HNTB.

Table 16 also shows a tabulation of telephone calls for three months following the test. The calls show a pattern similar to calls during the test. The phone lines were kept open past March 31, but by that time most callers were complaining about specific noise incidents and not commenting on the scatter plan.

TABLE 16

TELEPHONE RESPONSE BY COMMUNITY

Community	During Test Oct. 24, 1983 – Jan. 7, 1984					After Test Jan. 8, 1984 – Mar. 31, 1984				
		In Favor		Opposed			In Favor		Opposed	
	Total	Calls	Percent	Calls	Percent	Total	Calls	Percent	Calls	Percent
Accokeek	33	29	88	4	12	11	3	27	8	73
Alexandria	1,184	864	73	320	27	163	42	26	121	74
Annandale	681	7	1	674	99	120	1	1	119	99
Arlington	8,030	752	9	7,278	91	1,381	30	2	1,351	98
Bethesda	1,290	961	74	329	26	281	69	25	212	75
Brookmont	53	34	64	19	36	15	11	73	4	27
Cabin John	208	198	95	10	5	12	11	92	1	8
Chevy Chase	658	43	7	615	93	187	3	2	184	98
Fairfax	249	19	8	230	92	18	0	0	18	100
Falls Church	1,581	32	2	1,549	98	381	1	0	380	100
Ft. Washington	193	151	78	42	22	24	7	29	17	71
McLean	753	340	45	413	55	157	18	11	139	89
NW Washington	2,145	650	30	1,495	70	891	22	2	869	98
Oxon Hill	43	21	49	22	51	66	9	14	57	86
Potomac	261	244	93	17	7	19	8	42	11	58
Silver Spring	64	8	13	56	87	14	4	29	10	71
SE Washington	76	23	30	53	70	13	3	23	10	77
SW Washington	62	25	40	37	60	18	1	6	17	94
Springfield	135	6	4	129	96	25	0	0	25	100
Vienna	63	20	32	43	68	22	0	0	22	100
Other	198	79	40	119	60	35	9	26	26	74
Totals	17,960	4,506	25	13,454	75	3,853	252	7	3,601	93

Source: HNTB analysis of FAA data.

2. Mail

Nearly 1000 letters were received by MWA during and immediately after the test of the scatter plan. As with the phone calls, 25 percent of the letter writers supported the scatter plan and 75 percent opposed it. A summary of the written response by community is presented in Table 17.

TABLE 17

WRITTEN RESPONSE BY COMMUNITY

Community	Favored	Opposed
Virginia:		
Alexandria	20	23
Annandale	2	43
Arlington	36	385
Fairfax	0	8
Falls Church	0	53
McLean	31	15
Springfield	0	10
other Virginia	5	4
Maryland:		
Accokeek	5	0
Bethesda	51	33
Brookmont	8	0
Chevy Chase	4	76
Cabin John	12	0
Potomac	10	0
Other Maryland	8	6
District of Columbia: (Zip Codes)		
20007	17	5
20008	0	12
20015	2	25
20016	25	27
Other DC Zip Codes	10	18
Total	246	743

Source: Federal Aviation Administration.

APPENDIX A

CORRESPONDENCE CONCERNING IMPLEMENTATION OF THE SCATTER PLOT TEST

metropolitan washington
COUNCIL OF GOVERNMENTS
1875 Eye Street, N.W., Suite 200, Washington, D.C. 20006 223-6800

May 19, 1981

Mr. James A. Wilding
Director, Metropolitan Washington
Airports
Hangar #9
Washington National Airport
Washington, D.C. 20001

Dear Mr. Wilding:

At its May 13, 1981 meeting, the Board of Directors of the Metropolitan Washington Council of Governments (COG) voted to request the Federal Aviation Administration (FAA) to conduct a demonstration test of the scatter plan proposal developed by the Metropolitan Area Coalition on Airport Problems (CAP) and the Prince George's County Advisory Board on National Airport Operations.

The Board is aware that such a test could not begin before this Fall at the earliest, because of the need to conduct certain environmental analyses, fund and design a comprehensive noise survey and monitoring program, and complete a "before" survey, before the actual test could start.

As in the past, our Staff plans to work closely with the FAA in the development and conduct of this project. Mr. Grant will be in touch with you shortly to begin initial planning discussions.

Thanks again for your continuing cooperation and assistance on this difficult and sensitive problem.

Sincerely,

Walter A. Scheiber
Executive Director

cc: Albert A. Grant
Charles C. Erhard

PROPOSAL FOR A

FLIGHT PATH DEMONSTRATION TEST

FROM WASHINGTON NATIONAL AIRPORT

Metropolitan Area Coalition on Airport Problems

Prince George's Advisory Board on National Airport Operations

25 March, 1981

SUMMARY

Council of Governments resolutions of April and June, 1980 call for the development and test of flight patterns at Washington National Airport which will more equitably distribute the noise of commercial jet airliners.

This is a proposal for such a test pattern. The proposal made here has as its central elements an early turn toward destination, a more equitable distribution of flight paths than previously attempted at WNA, and a more rapid attainment of altitude as consistent with ATA procedures.

This plan is submitted by the Metropolitan Area Coalition on Airport Problems ("CAP") and the National Airport Operations Advisory Board of Prince George's County following a survey of a number of major airports in the United States and consultation with pilots and controllers working out of WNA.

The essential elements of the proposed departure procedures are as follows:

1. North departures:

   (a) Aircraft will fly a middle of the river visual course (or 326° radial in low ceiling) for a distance of two miles (and at least 1,500 feet altitude).

   (b) Aircraft with westerly destinations will then turn to destination at this point.

   (c) Aircraft with easterly destinations which can and presently do turn up the Anacostia River will continue to do so. Other easterly bound planes will continue to the northern boundary of the prohibited zone and turn to destination.

   (d) Aircraft will use revised (1976) ATA takeoff procedures.

2. South departures:

(a) Aircraft will follow a middle of the river visual course (or 183° radial in low ceiling) for a distance of three miles (and at least 1,500 feet altitude) and then turn (over the Wilson Bridge and Beltway) to destination.

(b) Aircraft will use revised (1976) ATA takeoff procedures.

This proposal is unique in that it breaks out of the rigid parameters of all previous proposals, and it addresses a hitherto neglected key element of discomfort and grievance — the number of overflights in measured periods. Recent NASA experiments simulating aircraft overflights and using people as the responding targets have shown that in all instances a high frequency of overflights was cited as an important element in severe discomfor In some cases frequency of overflights was more disturbing than the actual sound levels. This proposal also, for the first time, breaks out of the river corridor which has greatly limited the possible areas of dispersal. All previous tests and flight practices put up to 300 flights per day over the same geography while attempting either modest sound reduction or some distribution of the louder, climb-power sound.

The proposed test will save time, fuel and money. It will increase safety factors by achieving higher altitudes more quickly. It will decrease the time required for each flight by the WNA controllers.

Most importantly, for the first time in the Washington metropolitan area, it will provide a chance for relatively few overflights over any one ground line.

The protocol for this test will be similar to that of previous tests. The FAA and COG will again assume duties and responsibilities as before. The test ideally ought to be conducted two months in midsummer and two months in midwinter.

Because endless tinkering with the present river paths has produced so little in the way of improvement in the jet noise problem at WNA, it seems an almost inescapable conclusion that some new, truly flight-dispersing plan be tried.

Unlike previous tests, this proposal costs less, reduces burdens on pilots and controllers, and is thoroughly sound from the point of view of public safety and comfort.

HISTORY

Jets were introduced at WNA in 1967. As a concession to widespread criticism of the move, the flight paths were over the Potomac River. They have essentially remained there while numbers of flights have increased steadily. In 1977, the south takeoff path was moved to the 183° radial. This moved it closer to Maryland and has brought unremitting complaint. In 1979 a test was conducted which kept the same flight path to the north but extended the straight line portion of the south path to a minimum of ten miles. A hearing after this test produced almost unanimous adverse public comment, and COG voted against the permanent establishment of this flight pattern.

COG subsequently passed resolutions (April-June, 1980) calling for a plan to more equitably spread the burden of jet noise. A plan produced by the FAA called for continuing over-the river flights with 3,000 feet altitude as the mechanism for dispersal of the points at which different planes would turn toward next course. There was intense opposition to this plan and it was rejected by the COG Board.

A committee has been appointed pursuant to a COG Board motion which consists of COG members and some citizen representation.

THE FLIGHT PATH DEMONSTRATION TEST PROPOSAL

In preparing to develop this plan we have sought information from near and from far: air traffic controllers at National Airport, airline pilots, professional associations, and airport managements in other cities such as Atlanta, West Palm Beach, Chicago, and St. Louis. The most significant result of these conversations is that there is considerably more flexibility in aircraft operation and control procedures than we had previously concluded based upon local experience. Jet airliners can climb very quickly with attendant savings in flight time and fuel and increases in safety. At some airports the aircraft are turned onto new directions immediately upon liftoff from the runway; at others they are turned onto completely new headings at distances of two to three miles after leaving the runway. The variations are seemingly limitless.

The proposed new flight path plan is simple and easily stated:

1. North departures:

   (a) Aircraft will fly a middle of the river visual course (or 326° radial in low ceiling) for a distance of two miles (and at least 1,500 feet altitude).

   (b) Aircraft with westerly destinations will then turn to destination at this point.

   (c) Aircraft with easterly destinations which can and do turn up the Anacostia River will continue to do so. Other easterly bound planes will continue to the northern boundary of the prohibited zone and turn to destination.

   (d) Aircraft will use revised (1976) ATA takeoff procedures.

2. South departures:

   (a) Aircraft will follow a middle of the river visual course (or 183° radial in low ceiling) for a distance of three miles (and at least 1,500 feet altitude) and then turn (over the Wilson Bridge and Beltway) to destination.

   (b) Aircraft will use revised (1976) ATA takeoff procedures.

This plan has many merits:

1. The number of overflights over any one area are greatly reduced. (See Figures 1 and 2). Recent studies have shown that jet noise impact is more accurately measured by the frequency of jet passages rather than by the specific jet noise level.

2. The jets are quickly put onto a course to their next destination thereby minimizing the flight path distance over the metropolitan area. The total flight path distance determines how many people are impacted by the noise.

3. This plan reduces flight time and fuel consumption.

4. The "up and out" ascent feature further contributes to reduced flight times and fuel consumption (See Figure 3).

5. The ascent would place the noisier overflights in districts with already high ambient noise levels from sources such as trucks, automobiles, etc. It is important to remember that the annoyance from sound is produced by the increase of the aircraft noise over the background noise level and thus for a given absolute level of jet noise the noise impact or annoyance is less in areas of higher ambient noise levels.

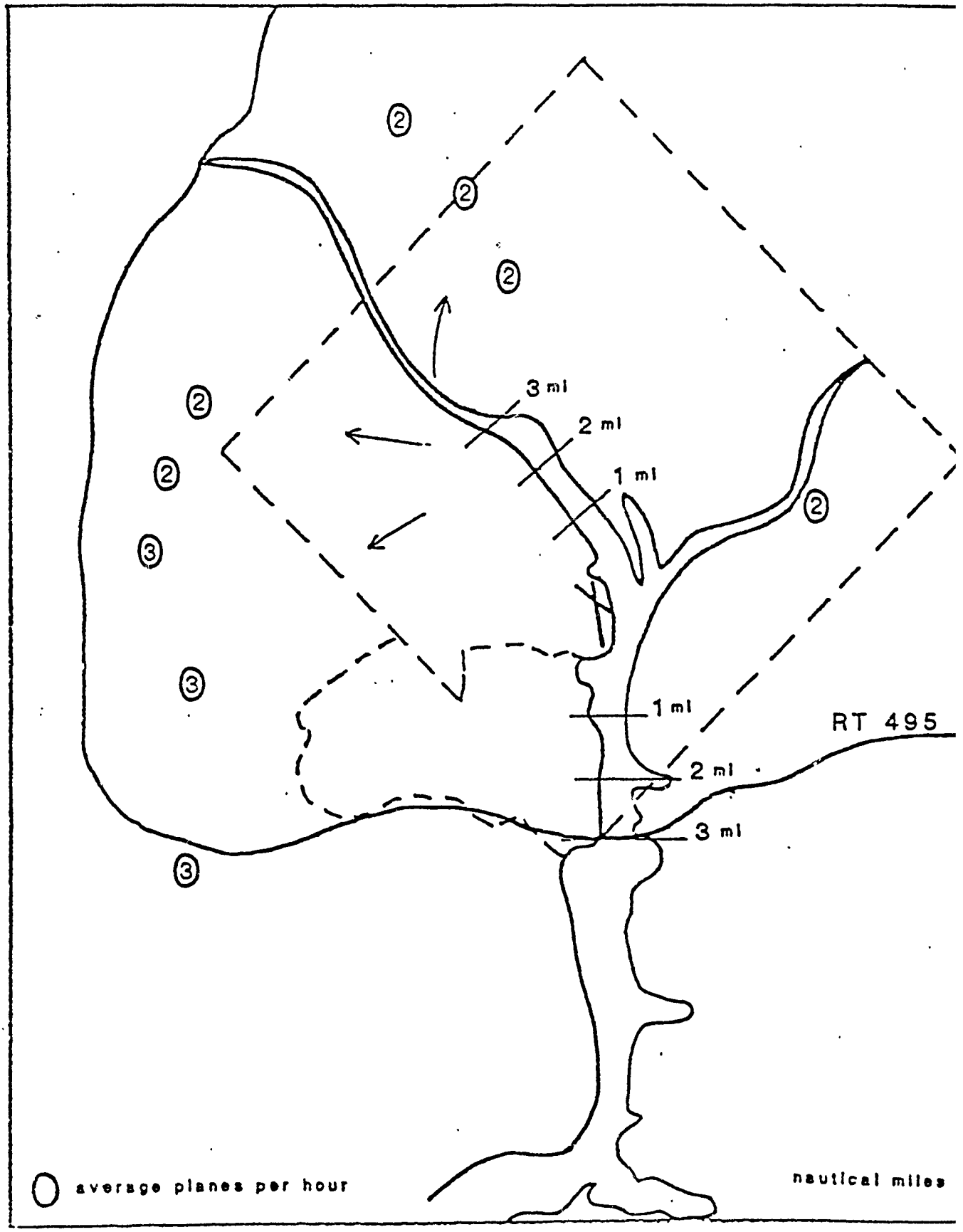
6. The "up and out" ascent promotes safety because the aircraft climb more rapidly.

No plan of this type with early turn to destination and more rapid ascent to higher altitudes has been tested here. All previous plans have focussed upon longer and longer flight paths and slower and slower aircraft ascent rates.

A variation of the proposal might be to seek a temporary modification of the District prohibited zone to permit a test of an easterly turn on north departure at the two mile or 1,500 feet altitude point.

This plan should be tested for approximately two months in summer and two months in winter to assess the effects of the seasonal variations upon aircraft performance and upon residential communities.

NORTH DEPARTURES



FIGURE

SOUTH DEPARTURES

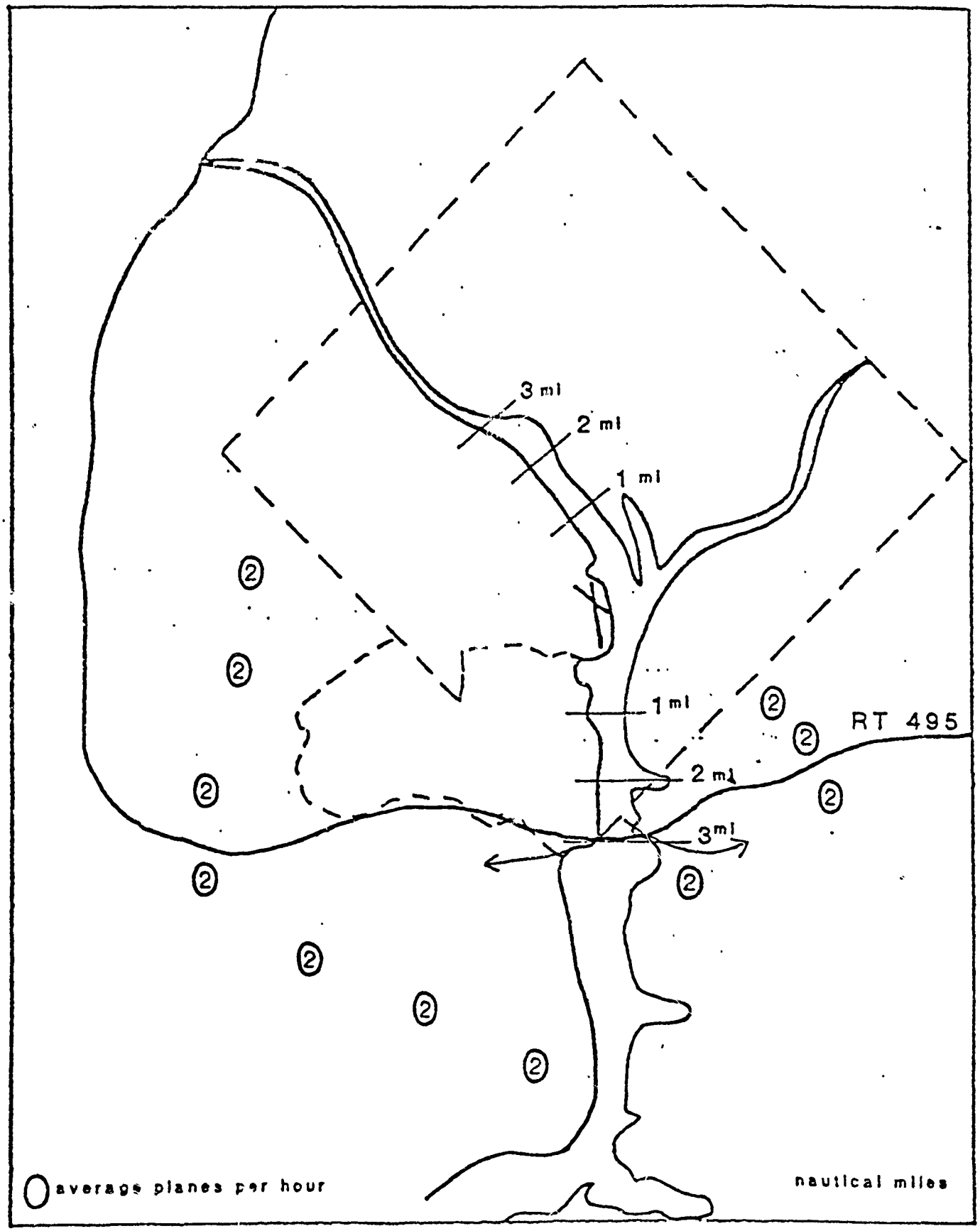
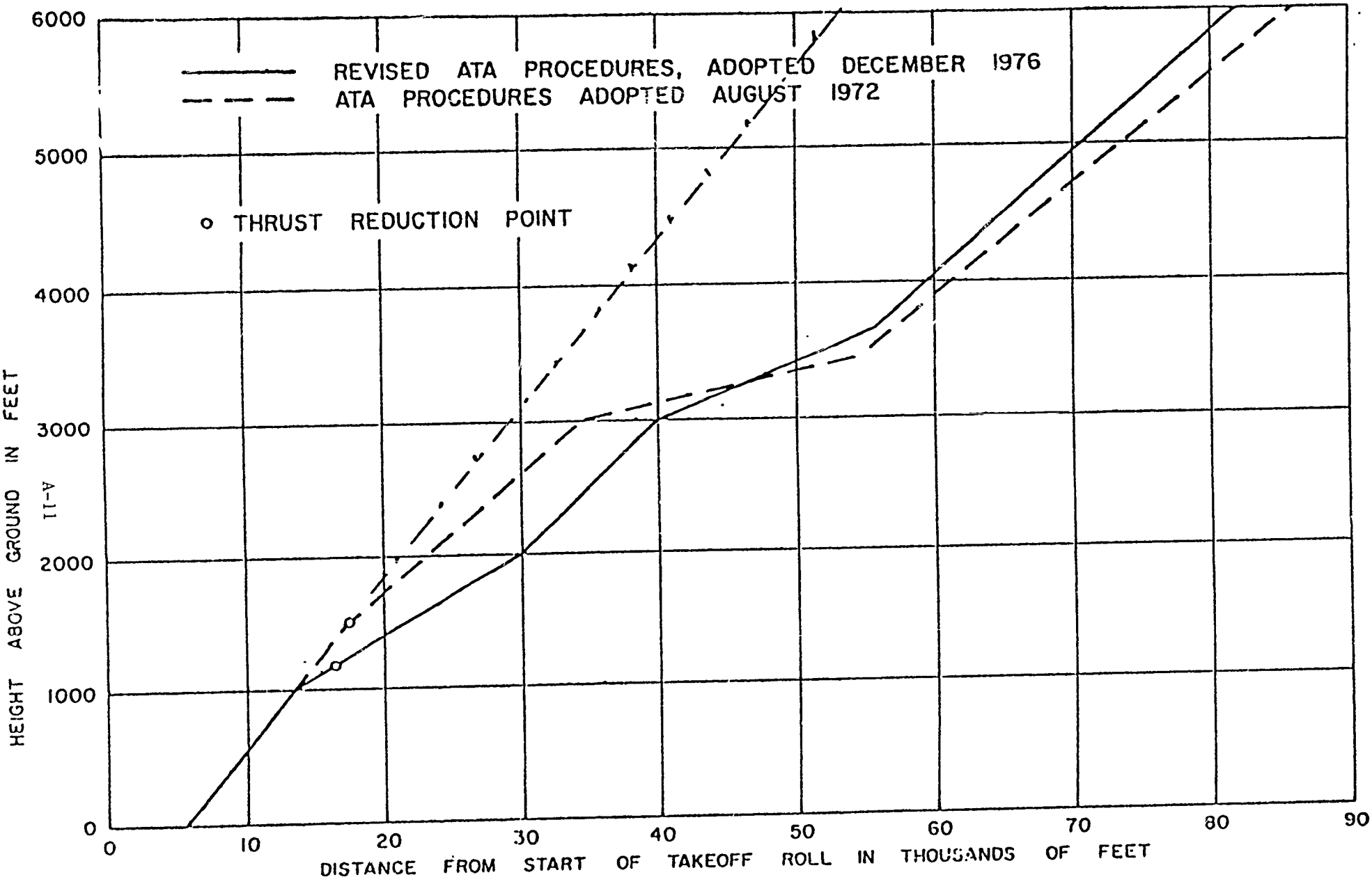


FIGURE 2



COMPARISON OF ATA PROCEDURES FOR 3-ENGINE LBPR TURBOFAN TRANSPORT AIRCRAFT -- 727 SERIES

FIGURE 3

C O P Y

U.S. Department
of Transportation
Federal Aviation
Administration

Metropolitan Washington Airports
Washington National Airport Hangar 9
Washington, D.C. 20001

November 18, 1981

Mr. Walter A. Scheiber
Executive Director
Metropolitan Washington
Council of Governments
1875 Eye Street, NW., Suite 200
Washington, D. C. 20515

Dear Mr. Scheiber:

At its May 13 meeting, the COG Board of Directors requested the Federal Aviation Administration (FAA) to test the scattering of aircraft departures from Washington National Airport. The particular scatter test requested by the Board was one devised by the Metropolitan Area Coalition on Airport Problems and the Prince Georges County Advisory Board on National Airport Problems.

As agreed following the Board's request, we proceeded to prepare an environmental assessment of the scatter plan, a necessary prelude to the FAA's decision whether or not to conduct such a test. Our plans were to distribute that assessment throughout the region and invite comments on it. Once those comments were in hand, we would then have proceeded to make our decision on the test and, if that decision were affirmative, we had hoped that such a test could have been instituted in the spring of 1982. That, of course, assumed that COG would be prepared to undertake the public opinion survey phases of the test by that time, similar to the arrangements which were used in the summer 1979 tests of the extended flight path south of the airport.

While this same general sequence of events continues to be appropriate, it is now clear to us that the schedule must, unfortunately, be modified in light of the current air traffic situation. As you know, quite a large number of the FAA's air traffic controllers engaged in an illegal strike and have since been terminated. The air traffic system is in a recovery mode and the flow of air traffic has been constrained to bring the demands on the system into line with the reduced system capacity. The flow of aircraft into and out of Washington National has been limited as a part of that overall recovery effort.

The conduct of a test such as that which COG has requested imposes a rather substantial burden on the air traffic operation at National. We now believe, given the current situation, that we cannot deal with that burden before the end of 1982 at the very earliest.

Given this turn of events, we plan to suspend the scatter-planning process until the spring of 1982, and to assess the air traffic situation at that time. If we then believe that we could, in fact, handle such a test by the end of 1982, we will publish the environmental assessment in the spring, invite regional comments, and proceed along the course outlined above. We feel that this approach is preferable to proceeding now to move toward an early decision on a test, only to then not be able to follow through immediately with the actual test should an affirmative decision to be made.

I regret that this delay is necessary, but we believe that our first priority must be to restoring capacity to the air traffic system as a part of the overall strike recovery program.

Sincerely,

/Original Signed By/

James A. Wilding, Director
Metropolitan Washington Airports

U.S. Department
of Transportation
**Federal Aviation
Administration**

Metropolitan Washington Airports
Washington National Airport Hangar 9
Washington, D.C. 20001

May 31, 1983

In early 1981 the Washington Metropolitan Area Coalition on Airport Problems (CAP) and Prince George's Advisory Board on National Airport Operations presented to the Metropolitan Washington Council of Governments a "Proposal for a Flight Path Demonstration Test from Washington National Airport." The COG Board of Directors in turn requested the Federal Aviation Administration to conduct a demonstration test of the plan. The plan calls for less use of river departure paths than occurs under current procedures, with earlier turnoffs for departing aircraft, and it is generally described as the "scatter plan."

In accordance with Federal regulations, the proposed conduct of the test is subject to the environmental review process. An environmental assessment of the effects of the test has accordingly been prepared, a copy of which is enclosed for your review.

Public comment on the assessment report will be received through the period ending on July 20. If you have any comments on the proposal, you are invited to submit them in writing to the Manager, Operations Division, Federal Aviation Administration, Washington National Airport, Washington, D. C. 20001. After assessing all comments, the Federal Aviation Administration will make a decision on whether to proceed with a test. If a test is conducted, it would likely occur in the fall of 1983.

James A. Wilding, Director
Metropolitan Washington Airports

Enclosure

U.S. Department of Transportation
Federal Aviation Administration

Memorandum

Subject: ACTION: Washington National Airport Scatter Plan Test — Date: August 30, 1983

From: J. Lynn Helms, Administrator — Reply to Attn of:

To: James A. Wilding, Director, Metropolitan Washington Airports, AMA-1

This is a follow-up to our recent meeting concerning the proposed test of a scatter plan for turbojet departures at Washington National Airport. The following reflects my decision on conducting the test and my thinking in reaching that decision.

Any large organization, to have order, must have a structure. In the body politic, citizens may elect aldermen, or mayors, or council persons. The citizenry, through its local representatives, then may decide, further, to form a regional representational body to deal with problems common to an area's various political subdivisions. In the Washington, D. C., metropolitan area, such a regional representational body has been formed. It is the Metropolitan Washington Council of Governments (COG). Federal agencies are, on occasion, called to respond to the concerns of the COG as the voice of the Washington area population.

I recognize that in the mid-1970's, FAA started working with COG on aircraft noise problems. In early 1981, the Washington Metropolitan Area Coalition on Airport Problems (CAP) and the Prince George's Advisory Board on National Airport Operations presented to COG a "proposal for a flight plan demonstration test from Washington National Airport." The COG Board of Directors in turn requested the FAA to conduct a demonstration test of the plan. The plan calls for less use of river departure paths than occurs under current procedures, with earlier turn-offs for departing aircraft, and it is generally described as the "scatter plan."

The FAA evaluation of the plan determined it was safe and feasible. In accordance with Federal regulations, the proposed conduct of the test is subject to the environmental review process. It is not FAA's role to make a determination that such a test would be acceptable to the various political subdivisions. Such a local governmental responsibility lies with the local jurisdictions. The environmental assessment of the test, the public review and commentary upon the potential test effects, and the implementation of the test plan were delayed when FAA advised COG that the illegal air traffic controller strike limited the FAA capability.

In July 1983 the COG Board of Directors reaffirmed the 1981 request to conduct the test.

Approximately 650 comments received to date by FAA in response to the May 1983 environmental assessment are split equally between proponents and opponents. Because of this high degree of interest on the part of the citizenry, I believe we must clearly recognize that:

a. The test was requested by the people, through COG--not by FAA.

b. The test was developed by COG--not FAA.

In addition, I have concluded that:

a. The test "scatter plan" is safe and can be implemented.

b. It is the responsibility of Government officials to respond to the people, in this case represented by COG.

Accordingly, I am authorizing the "scatter plan" test to be conducted for up to 90 days sometime within the period beginning September 15, 1983, and ending January 15, 1984. I specifically reserve the right to cancel the "scatter plan" test program at any time that safety, operational, or other meaningful events result in my determination to cancel the program. At the conclusion of this test, we must ensure that the departure procedures are returned to those presently in use, while any further analysis and study of the test results are conducted.

#

U.S. Department
of Transportation
**Federal Aviation
Administration**

Metropolitan Washington Airports
Washington National Airport Hangar 9
Washington, D.C. 20001

September 1, 1983

Mr. Walter Scheiber
Executive Director
Metropolitan Washington
Council of Governments
1875 Eye Street, N.W., Suite 200
Washington, D. C. 20006

Dear Walt:

We have just concluded the environmental process concerning the proposal to test the scattering of turbojet aircraft departures from Washington National Airport. In light of COG's continuing desire to have the plan tested, Federal Aviation Administrator J. Lynn Helms has decided that such a test will, in fact, be conducted. I am enclosing for your information a copy of Mr. Helms' decision memo which includes, as you will note, his thinking in reaching that decision.

Our staffs have been working closely together on this matter for some time now and we look forward to continuing to work with COG in the test phase of the project.

Sincerely,

James A. Wilding, Director
Metropolitan Washington Airports

Enclosure

ORDER DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

DCA-T-7210-44

WASHINGTON TOWER

17 Oct 1983

SUBJ: "SCATTER PLAN TEST"

1. PURPOSE. To provide information and guidance.

2. DISTRIBUTION. All Washington Tower Personnel.

3. BACKGROUND. The scatter plan test is now 'on' again due to a ruling by the appeals court that the lower court did not have jurisdiction in the matter. During these proceedings, the FAA advised the court the earliest they could start the plan was October 24, 1983. With this in mind, we will plan on conducting the test although further court proceedings may affect the starting date.

   From strictly an Air Traffic Standpoint, all the Scatter Plan does is allow the departure controller to vector jet aircraft away from the Potomac River corridor closer to the airport. It does not mandate that you do. It is not our job to Scatter these aircraft. Scattering will automatically occur as it does today simply due to the amount, the mix and types of traffic, weather, communications and all other factors.

4. ACTION.

   a. The Scatter Plan test will begin at 0700 local time, October 24, 1983, or as directed by the Courts.

   b. The test will be conducted over a period of not more than 90 days between the hours of 0700-2200 local time and will affect Jet departures only.

   c. Jet departures during the late night hours, 2200-0700 and all propeller aircraft will continue to be handled by published Noise Abatement Procedures.

   d. The early turning points are as follows:

      North Operation - Westbound 2.2 DME (approx 3 mile radar range)
      Eastbound 5 DME (approx 6 mile radar range, North of P-56B)
      South Operation - East or Westbound 4 DME (approx 3 mile radar range)

Distribution: All Personnel
cc: AEA-540

Initiated By: WT-3

FAA Form 1320-1.1 (12-72)

e. The airspace of DR-1 and AR-1 (North) have been altered, assigning the DR-1 the altitudes of 5,000 and 5,500 feet in that portion of airspace southwest of DCA as outlined on the attached Airspace Charts.

Note: Jet departures will continue to utilize the Washington Noise Abatement two stage climb.

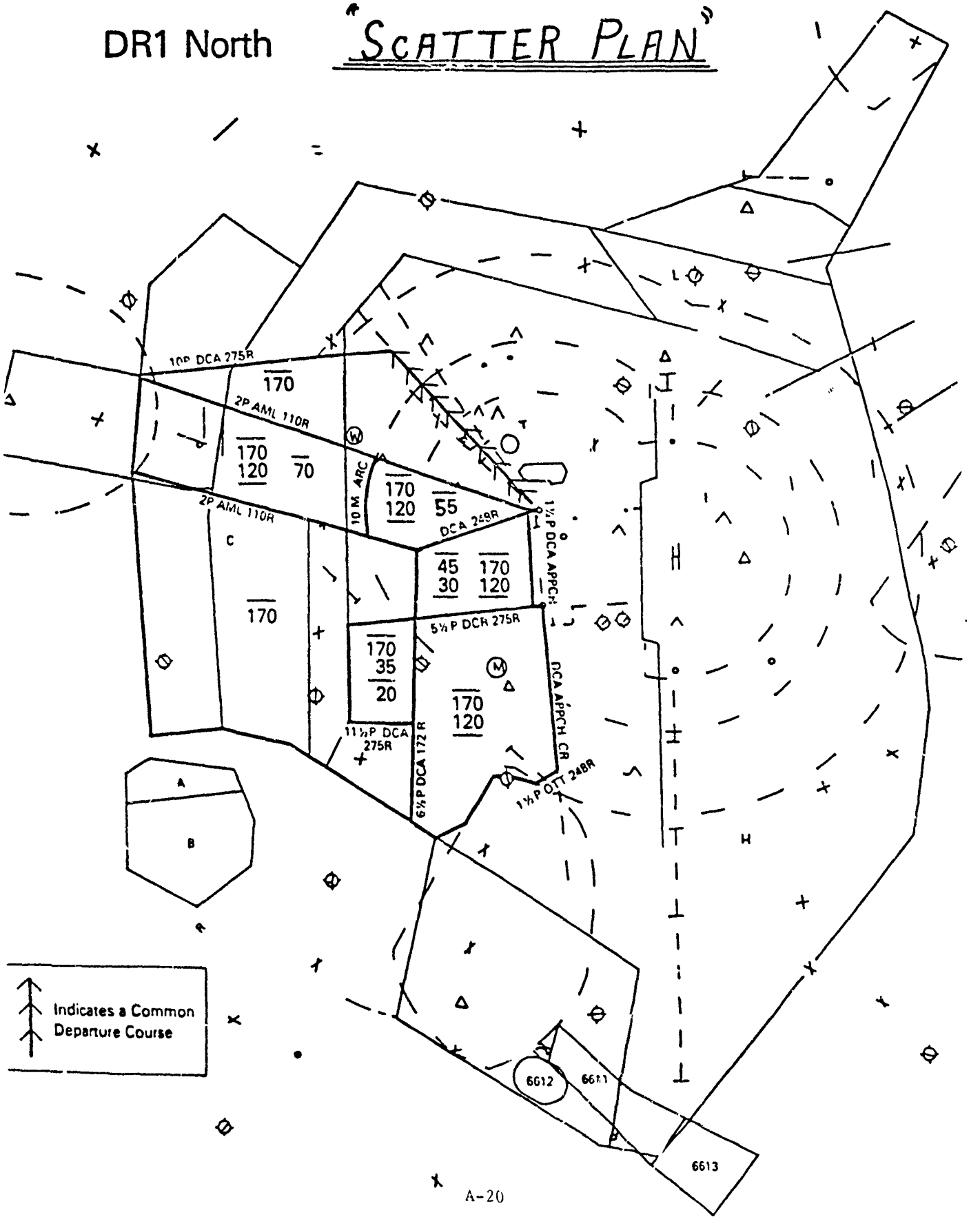
f. Weather minima prescribed Departure Clearance phraseology is changed from ceiling of 3000 feet to 2,500 feet with respect to the use of the phrase "VIA NOISE ABATEMENT".

/Harry T. Hubbard

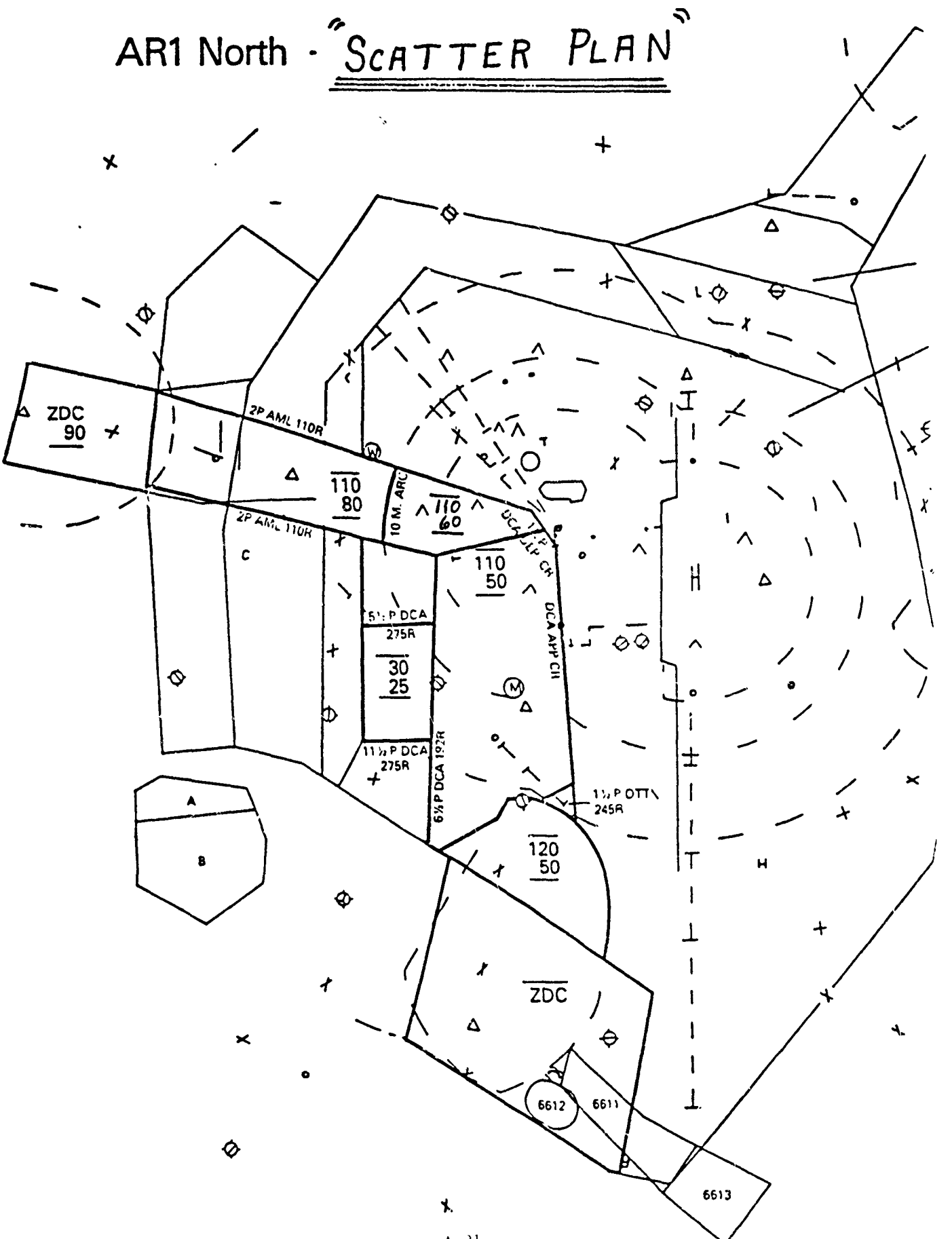
HARRY T. HUBBARD
Manager, Washington Tower

Attachments

DR1 North "SCATTER PLAN"



AR1 North - "SCATTER PLAN"



NOTICE

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

DCA-T-N-7210.80

WASHINGTON TOWER

Cancellation Date: 2/7/84

SUBJ: Cancellation of "Scatter Plan Test"

1. PURPOSE. To cancel Washington Tower Order DCA-T-7210-44

2. DISTRIBUTION. All Washington Tower Personnel

3. ACTION. Effective 2200 LCL, Saturday 1/7/84, the subject order is cancelled.

   The "Scatter Plan Test" will be terminated at this time and traffic will be confined to the previously approved noise abatement procedures.

for HARRY T. HUBBARD
Manager, Washington Tower

Distribution:

Initiated By:

APPENDIX B

COMMUNITY ATTITUDINAL SURVEY QUESTIONNAIRE

SITE: _____

INTRODUCTION: "This is (interviewer name) calling for the Washington Council of Governments. We're conducting a study of environmental conditions in the Washington area, and would appreciate a few moments of your time to answer some brief questions."

ITEM	QUESTION	RESPONSE CODE	CC
1	How long have you lived on (street name)? Verbatim: _____	Number of months .... ___ Don't know ..... 777 Not Ascertained ..... 888 Refused 999	(25-27)
2	How would you rate your neighborhood as a place to live? Would you say it's a very poor place to live, a poor, fair, good, or an excellent place to live?	Very Poor ..... 0 Poor ..... 1 Fair ..... 2 Good ..... 3 Excellent ..... 4 Don't Know ..... 7 Not Ascertained ..... 8 Refused 9	(28)
3	While you've been at home during this past week, just since last (Fri/Sat/Sun), have you been bothered or annoyed by street traffic noise? If Yes, ASK: Would you say you've been slightly annoyed by street traffic noise, moderately annoyed, very annoyed or extremely annoyed by street traffic noise?	No (Not at all Annoyed). 0 Slightly Annoyed ..... 1 Moderately Annoyed ..... 2 Very Annoyed ..... 3 Extremely Annoyed ..... 4 Don't Know ..... 7 Not Ascertained ..... 8 Refused 9	(29)
4	Would you say that over the past year, your neighborhood has been quiet or noisy? IF QUIET, ASK: Would you say it's been slightly quiet, moderately quiet, very quiet or extremely quiet? IF NOISY, ASK: Would you say it's been slightly noisy, moderately noisy, very noisy or extremely noisy?	Slightly Quiet .....10 Moderately Quiet ..... 20 Very Quiet ..... 30 Extremely Quiet ..... 40 Slightly Noisy ..... 01 Moderately Noisy ..... 02 Very Noisy ..... 03 Extremely Noisy ..... 04 Don't Know ..... 77 Not Ascertained ..... 88 Refused 99	(30,31)
5	While you've been at home this past week, have you been bothered or annoyed by aircraft noise? IF YES, ASK: Would you say you've been slightly annoyed by aircraft noise, moderately annoyed, very annoyed or extremely annoyed by aircraft noise?	No (Not at all Annoyed). 0 Slightly Annoyed ..... 1 Moderately Annoyed ..... 2 Very Annoyed ..... 3 Extremely Annoyed ..... 4 Don't Know ..... 7 Not Ascertained ..... 8 Refused 9	(32)
6	While you've been at home this past month, have you been bothered or annoyed by aircraft noise? IF YES, ASK: Would you say you've been slightly annoyed by aircraft noise, moderately annoyed, very annoyed or extremely annoyed by aircraft noise?	No (Not at all Annoyed). 0 Slightly Annoyed ..... 1 Moderately Annoyed ..... 2 Very Annoyed ..... 3 Extremely Annoyed ..... 4 Don't Know ..... 7 Not Ascertained ..... 8 Refused 9	(33)

ITEM	QUESTION	RESPONSE	CODE	CC
7	While you've been at home this past year, have you been bothered or annoyed by aircraft noise? IF YES, ASK: Would you say you've been slightly annoyed by aircraft noise, moderately annoyed, very annoyed or extremely annoyed by aircraft noise?	No (Not at all Annoyed) ..... Slightly Annoyed ..... Moderately Annoyed ..... Very Annoyed ..... Extremely Annoyed ..... Don't Know ..... Not Ascertained ..... Refused	0 1 2 3 4 7 8 9	(33)
8	While you've been at home this past week, have you noticed any more or fewer airplanes than usual?	No ..... Yes, fewer ..... Yes, more ..... Don't Know ..... Not Ascertained ..... Refused	0 1 2 7 8 9	(34)
9	While you've been at home this past week, were your windows generally open or shut?	Open ..... Shut ..... Don't Know ..... Not Ascertained ..... Refused	0 1 7 8 9	(35)

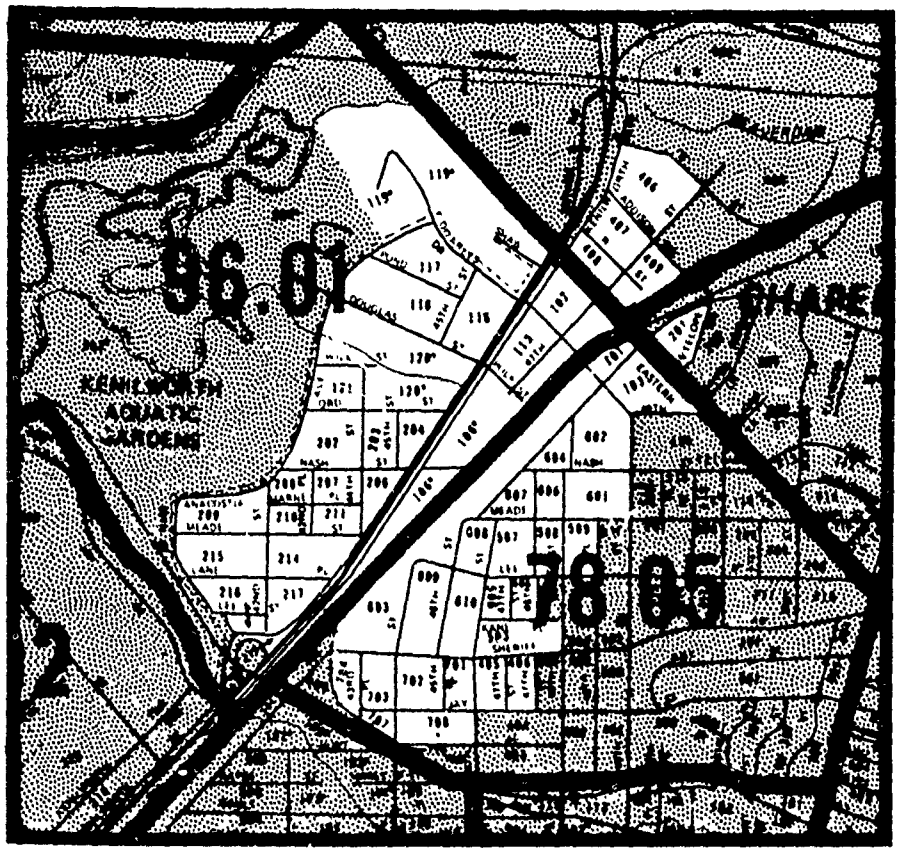
10 I'm going to mention a few things that sometimes concern people in neighborhoods like yours. Would you please tell me if they are of concern to you? Would you say you're (degree) concerned by (source)?

Concern	NAA	SLI	MOD	VRY	EXT	DK	NA	RF	
Air Pollution	0	1	2	3	4	7	8	9	(36)
Crime	0	1	2	3	4	7	8	9	(37)
Unemployment	0	1	2	3	4	7	8	9	(38)
Neighborhood Traffic Accidents ...	0	1	2	3	4	7	8	9	(39)
Aircraft Accidents	0	1	2	3	4	7	8	9	(40)
High Taxes	0	1	2	3	4	7	8	9	(41)
Heating Bills	0	1	2	3	4	7	8	9	(42)
Aircraft Noise	0	1	2	3	4	7	8	9	(43)

11 This past week, has aircraft noise: IF YES, ASK: Would you say that this happens rarely, occassionally or often?

	No	Rarely	Occasionally	Often	DK	NA	RF	
(a) Interfered with radio/TV listening	0	1	2	3	7	8	9	(44)
(b) Interfered with ordinary conversation in your home	0	1	2	3	7	8	9	(45)
(c) Disturbed your rest and relaxation	0	1	2	3	7	8	9	(46)

TRACT MAP: 59 SITE I



SITE I

Kenilworth, DC

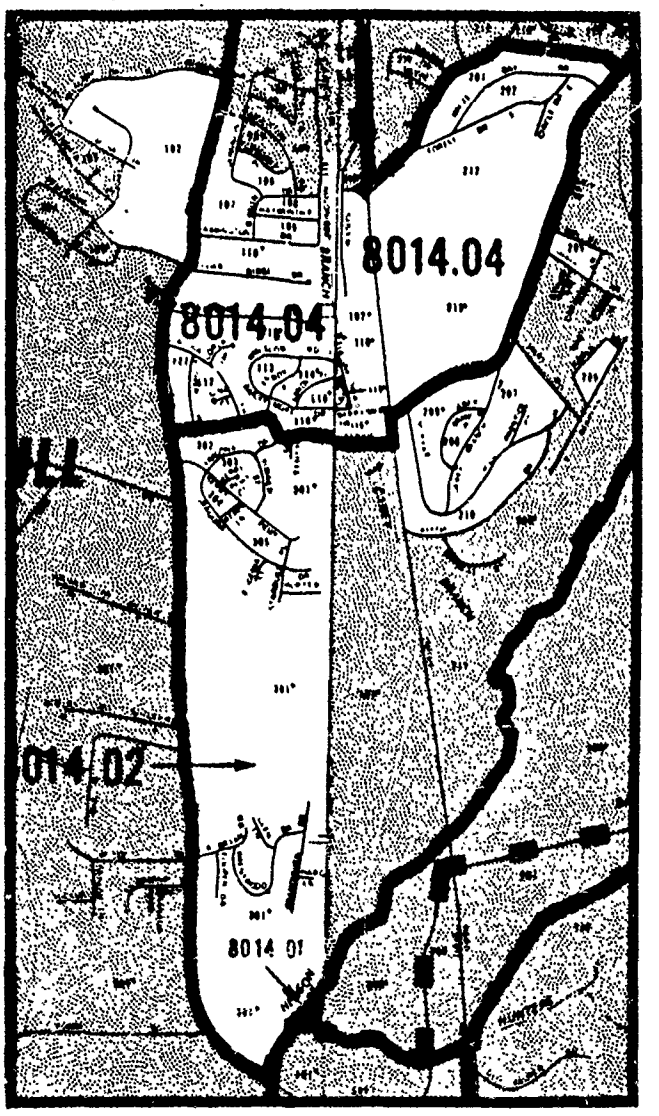
CENSUS TRACT: 96.01
BLOCKS: 102, 106, 111, 113, 116, 117, 118, 119, 120, 121, 202, 203, 204, 206, 207, 208, 209, 210, 211, 214, 215, 216, 217, 219

CENSUS TRACT: 8043
BLOCKS: 406, 407, 408, 409

CENSUS TRACT: 78.05
BLOCKS: 101, 103, 405, 406, 503, 504, 505, 506, 507, 508, 509, 601, 602, 603, 606, 607, 608, 609, 610, 701, 702, 703, 704, 706, 707, 708

CENSUS TRACT: 8031
BLOCK: 201

TRACT MAP: 77, 78 SITE P



SITE P

Oxon Hill, MD

CENSUS TRACT: 8014.04
BLOCKS: 102, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 201, 202, 212, 213

CENSUS TRACT: 8014.02
BLOCKS: 205, 206, 207, 208, 209, 210, 301, 302, 303, 304, 305

APPPENDIX C

GLOSSARY

GLOSSARY OF TERMS

Ambient Sound Level - The background sound level produced by all noise sources other than aircraft.

ATA - Air Transport Association, the industry trade group of the major U.S. airlines.

ATC - Air Traffic Control.

A-Weighted Sound Level (dBA) - Sound level measured in decibels, with certain frequencies weighted to correspond to the sensitivity of the human ear. The A-weighed sound level measures the approximate "noisiness" or "annoyance" of a sound.

BBN - Bolt Beranek and Newman Inc., the consultant hired by the Metropolitan Washington Council of Governments to analyze the noise impact of the Scatter Plan test on the population of the area.

COG - See Metropolitan Washington Council of Governments.

Decibel (dB) - A measure of sound pressure or intensity (expressed on a logarithmic scale, relative to a standard reference value).

dBA - See A-Weighted Sound Level.

DCA - The three letter code used to designate Washington National Airport.

Day-Night Sound Level (Ldn) - The average A-weighted sound level during a 24-hour period with a 10dB penalty applied to nighttime sound levels.

DME - Distance Measuring Equipment, used to measure the distance of an aircraft from the navigational aid.

Environmental Assessment - An assessment of the environmental impacts of a proposed federal action, required by the National Environmental Policy Act of 1969.

Equivalent Sound Level (Leq) - The level of a constant sound that would have the same sound energy as a varying sound measured over a specified time period.

Federal Aviation Administration (FAA) - A part of the U.S. Department of Transportation, responsible for promoting aviation and air safety. The FAA operates the two federally-owned air carrier airports, Washington National and Washington Dulles.

HNTB - Howard Needles Tammen & Bergendoff, the consultant hired by the Federal Aviation Administration to measure and report on changes in noise levels produced by the Scatter Plan test.

Integrated Noise Model (INM) - A computer model used to predict airport noise, using input data on operations, types of aircraft, departure and arrival profiles, engine power settings, etc.

Ldn - See Day-Night Sound Level.

Leq - See Equivalent Sound Level.

Lmax - The maximum sound level measured during a specified time period.

Lmin - The minimum sound level measured during a specified time period.

L10 (L50, etc.) - The sound level exceeded 10 percent (50 percent, etc.) of the time during a specified time period.

Metropolitan Washington Airports (MWA) - An agency of the Federal Aviation Administration responsible for the operation of the two federally-owned air carrier airports, Washington National and Washington Dulles.

Metropolitan Washington Council of Governments (COG) - An agency made up of the cities and counties of the Washington area, with responsibility for planning and studies that have a regional focus.

MWA - See Metropolitan Washington Airports.

Noise Contour - A line on a map connecting points of equal noise (as determined by any specified noise measure). Areas "inside" the contour generally experience noise greater than the contour value; areas "outside" the contour generally experience less noise.

NM - Nautical mile, equivalent to 1852 meters, approximately 6076 feet or 1.15 statute miles.

Profile - The altitude of an aircraft, relative to the distance from start of takeoff or landing.

Radial - A magnetic compass bearing extending from a navigational aid.

Slant Range Distance - The line of sight distance between an aircraft and an observer on the ground.

Time-Above-Threshold - The percentage of time during a specified period that the noise level exceeds a specified threshold value.

Track - The path of an aircraft above the ground, usually shown on a map.

VOR - VHF Omnidirectional Range, a navigational aid giving a pilot information on his bearing relative to the facility.

APPENDIX D

COMPARISON OF MEASURED AND CALCULATED NOISE DATA

A. Validation of File Data

The computer model used to calculate aircraft noise levels from operational data is the Integrated Noise Model (INM) Version 3.8. The model includes file data on noise levels associated with different aircraft types, carrying different power settings, for different distances (slant-range) between noise source and observer. A limited comparison of measured data and file data was conducted to confirm the validity of using this file data for DCA departures.

Air carrier turbojet aircraft departing the airport during the pre-test and test period generally utilized one of two departure profiles, the DCA procedure or the ATA procedure. The DCA procedure, specified in Washington National Airport policy, consists of a climb to 1500 feet at takeoff power, then a reduction to the climb thrust necessary to maintain a 500 feet per minute (FPM) climb at maximum weight until 10 miles from the airport. At this point, normal climb power is applied.

Under the ATA procedure, aircraft typically climb with takeoff power until they have "cleaned up" landing gear and flaps used for takeoff (beginning around 1000 feet) and have accelerated to an established speed. At this point, typically at 2500 feet, power is reduced to normal climb thrust. These profiles are included in the computer data base and are depicted graphically in Figure 11 of Chapter III.

The profile of each aircraft takeoff will differ slightly depending upon weight, weather conditions, aircraft type, and pilot technique. In fact, there was found to be a "spread" of profiles and thrust management procedures grouped about each of the specified profiles, the DCA procedure and the ATA procedure.

Single-event noise readings recorded at the Chain Bridge permanent noise monitoring site, which is very cose to the average flight track followed by aircraft departing National Airport and which therefore provides the best single-event data, were used to validate the noise levels used in the computer noise model. The readings were taken during June 1983 (pre-test) for the two most frequently used aircraft types at National Airport, the Boeing 727-200 and the McDonnell Douglas DC-9. Some variation in altitudes and noise levels can be expected during the course of the year due to varying temperatures, which directly affect aircraft performance. In addition, the two aircraft types include different aircraft/engine combinations, so that variation in noise levels exists within the same general aircraft type. The analysis, however, demonstrated clearly that some aircraft were being flown generally in compliance with the specified DCA procedure, while others were not.

A 727-200 flown in conformance with the DCA procedure should cross the Chain Bridge monitor at about 3200 feet, carrying 9100 pounds of thrust, and producing a peak noise level of 79.3 dBA. Aircraft flying the ATA procedure should overfly the monitor at about 3600 feet, carrying 11,360 pounds of thrust and producing a peak noise level of 84.5 dBA. These two profiles were included in the computer data base.

Of the 81 727-200 noise events analyzed at the Chain Bridge monitor, eight were in the 75-80 dBA range, averaging 79.0 dBA, with an average altitude of 3100 feet, readings consistent with the DCA procedure. The other 73 aircraft produced peak noise levels in the 81-92 dBA range, averaging 85.0 dBA, with an average altitude of 3250 feet. These readings are consistent with the ATA procedure, although the average altitude is lower than would be expected.

DC-9 aircraft following the DCA procedure would be expected to overfly the Chain Bridge monitor at about 3440 feet, producing a peak noise level of 77.7 dBA and carrying 9100 pounds of thrust. Following the ATA procedure, the aircraft would pass the monitor at about 3700 feet, producing 81.1 dBA with 10,820 pounds of thrust. These are the two DC-9 profiles included in the computer data base.

A total of 46 DC-9 departures were analyzed at the Chain Bridge site. Of these, 13 produced peak noise levels in the 75-78 dBA range, averaging 77.4 dBA at an altitude of 3400 feet, which matches very closely the DCA profile. The other 33 DC-9's produced noise levels in the 79-85 dBA range, averaging 80.8 dBA at an altitude of 3300 feet. The noise levels actually created by these aircraft are very close to what would be predicted if they were flying an ATA procedure; however, as with the 727-200's, the average altitude is a little lower than expected, probably a result of some partial adherence to the procedure specified in the DCA profile.

The above analysis confirms that the single-event data included in the computer data base provides a satisfactory basis for modeling departure profiles, being close to actual monitored data in the vicinity of Wasington National Airport.

B. Comparison of Ldn Values

To verify that the calculated Ldn noise levels provide an acceptable prediction of actual noise levels, the calculated Ldn values were compared to measured Ldn values. Sufficient data to make these calculations was available only for the FAA's permanent sites. A comparison of the measured and calculated values is shown in Table D-1. The average difference between calculated and measured values is 3 Ldn units for non-test and test conditions.

The tabulation should be regarded as providing only general validation of the calculated Ldn values, since:

- The measured data were from limited samples of five days on which the traffic flow was split between north and south flow. The split on these sample days did not precisely match the annual average split upon which the calculated Ldn values are based;

- Weather and air traffic conditions on the measured days did not exactly duplicate the average annual day's conditions;

- The measured data take account only of noise events that "trigger" the monitor and may include some non-aircraft noise events.

Given these factors, the spread of differences between measured and calculated values and the scale of the differences are interpreted as providing the general validation that is the purpose of the comparison.

TABLE D-1

COMPARISON OF MEASURED vs CALCULATED AIRCRAFT-ONLY LDN

Site	Non-Test Ldn		Test Ldn	
	Measured	Calculated	Measured	Calculated
11	54	55	53	51
12	60	55	58	52
13	65	62	63	60
14	65	61	64	61
15	69	68	68	70
16	64	67	63	65
17	67	63	67	61
18	63	58	64	59
19	66	70	67	70
20	61	61	65	60
21	54	58	58	58
22	53	54	55	53
23	53	55	56	53

Source: HNTB analysis of FAA data.

APPENDIX E

FOLD OUT OF TABLE 1

MONITORING LOCATIONS

TABLE 1

MONITORING LOCATIONS

Site No.	Jurisdiction/Community	Streets/Landmark
FAA PERMANENT MONITORING SITES		
11	Fairfax County/Langley Forest	Sorrell Street 200' east of Douglass Drive
12	Montgomery County/Cabin John	76th Street at Arden Road
13	Arlington/Chain Bridge	Northeast terminus of 36th Road
14	Washington/Potomac Palisades	Galena Place near Carolina Place, NW
15	Arlington/Rosslyn	Rolfe Street between 21st Road and dead end
16	Washington/Georgetown	35th Street and Volta Place, NW
17	Washington/Southwest	Fort McNair
18	Washington/Bellview	2nd Street 600' north of Chesapea Street, SE
19	Alexandria/Old Town	Near Potomac River at foot of Oronoco Street/Founders' Park
20	Prince Georges County/Fort Foote	Fort Foote Road at FAA Communications Site
21	Fairfax County/Marlan Forest	Warrington Place and Burtonwood Drive
22	Prince Georges County/Tantallon	Tantallon Drive 500' east of Monterey Circle
23	Fairfax County/Waynewood	Alyce Place cul-de-sac south of West Boulevard
24	Montgomery/Chevy Chase Terrace	Langdrum Lane cul-de-sac at Little Falls Park
3*	Fairfax County/Springfield	Meriweather Lane at Thomas Drive

*Monitoring Equipment was moved to Springfield but maintained the name "Dulles 3"

TABLE 1 (CONTINUED)

Site No.	Jurisdiction/Community	Streets/Landmark
TEMPORARY MONITORING SITES, NORTH OPERATIONS		
N A	Prince Georges County/Avondale	LaSalle Road/Carroll Manor Nursing Home
N B	Washington/McLean Gardens	39th Street and Newark Street, NW
N C	Washington/Anacostia	Near Sousa Bridge at Anacos a River, SW
N D	Washington/Rock Creek Park	Glover Road and Military Road, NW
N E	Fairfax County/Kirby Park	Westmoreland Road near Lemon Road
N F	Arlington/Arlington Hospital	George Mason Road and 17th Street
N G	Fairfax County/Sleepy Hollow	Sleepy Hollow Road at Sleepy Hollow School
TEMPORARY MONITORING SITES, SOUTH OPERATIONS		
S A	Alexandria/Brookville	Holmes Run Parkway and South Pickett Sreet
S B	Fairfax County/Belleview	6400 Quander Road/Quander Road Center
S C	Fairfax County/Woodlawn Village	Fort Belvoir
S D	Prince Georges County/Oxon Hill	Bock Road near Tucker Ice Rink
S E	Prince Georges County/Fort Washington	1000 Allentown Road/Friendly High School
S F	Prince Georges County/Accokeek	3400 Bryan Point Road/National Colonial Farm

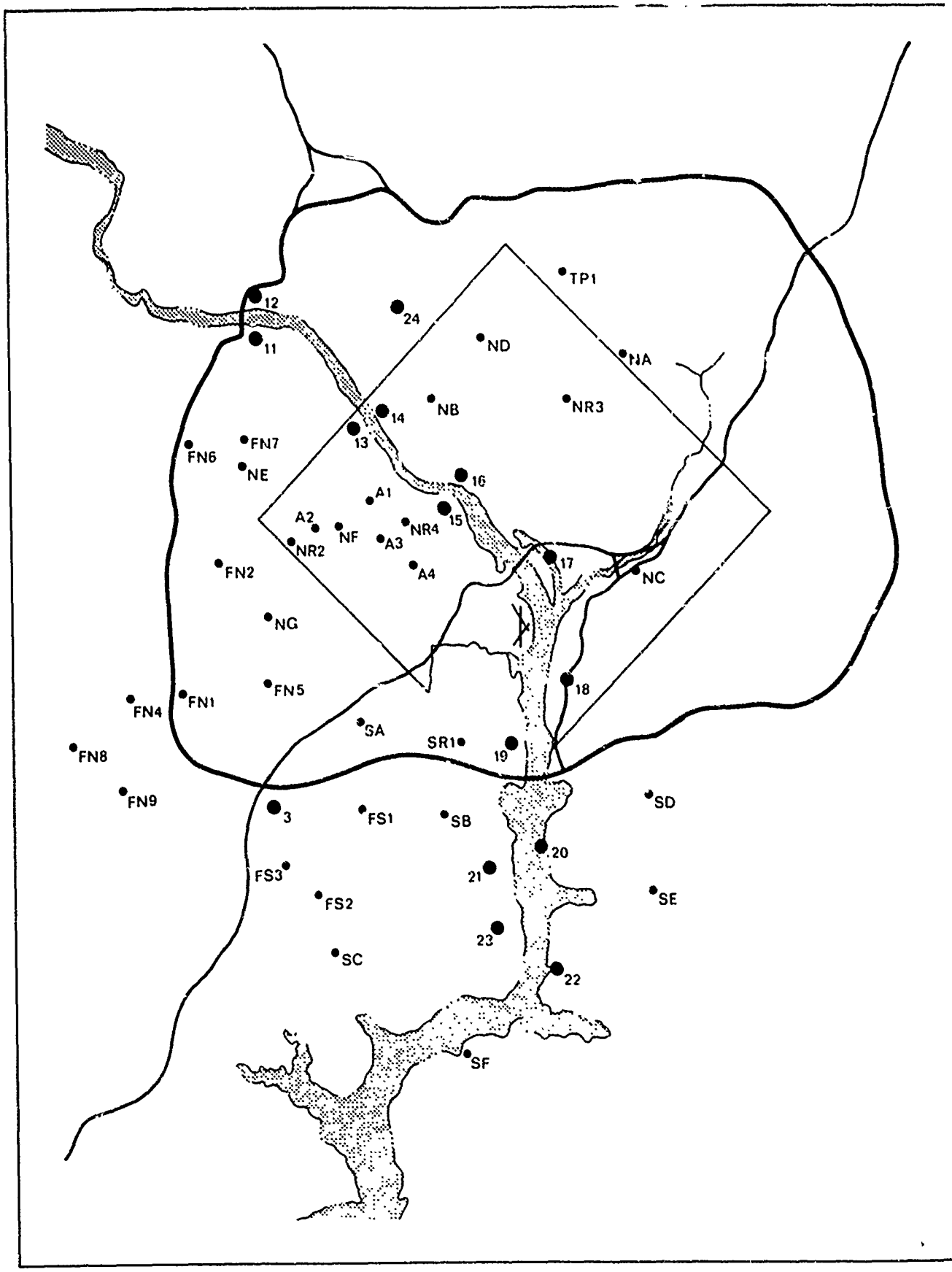
TABLE 1 (CONTINUED)

Site No.	Jurisdiction/Community	Streets/Landmark
MOBILE MONITORING SITES		
NR 2	Arlington/East Falls Church Park	North Roosevelt Street and 16th St.
NR 3	Washington/Soldiers' Home	North Capitol Street and Scale Gate
NR 4	Arlington/Lyon Village	Highland Street and Edgewood Street
SR 1	Alexandria/George Washington Park	Carlisle Drive
FN 1	Fairfax County/Annandale	Heritage Drive and Four Year Run/Ossian Hall Park
FN 2	Fairfax County/Devonshire Gardens	Graham Road/Devonshire School
FN 4	Fairfax County/Annandale	8415 Toll House Road/Wakefield Chapel
FN 5	Fairfax County/Annandale	6621 Columbia Pike/Mason District Park
FN 6	Fairfax County/McLean	Magarity Road/Westgate Park
FN 7	Fairfax County/McLean	1717 Melbourne Dr./Kent Gardens Sch
FN 8	Fairfax County/Burke	Burke Lake Road /Lake Braddock Park
FN 9	Fairfax County/Springfield	8600 Forrester Boulevard/Cardinal Forest School
FS 1	Fairfax County/Rose Hill Farms	6301 Rose Hill Drive/Rose Hill Sch.
FS 2	Fairfax County/Hayfield	7633 Telegraph Road/Hayfield School
FS 3	Fairfax County/Franconia	Beulah Street/Beulah Street Park
A 1	Arlington/Cherrydale	4100 N. Vacation Lane/Woodlawn Sch
A 2	Arlington/Westover	Washington Boulevard at Walter Ree School
A 3	Arlington/Ballston	Quincy Street/Quincy Playfield
A 4	Arlington/Ashton Heights	33 North Fillmore Street/Long Branch School
TP1	Montgomery County/Takoma Park	Piney Branch Road/Takoma Park Junior High School

APPENDIX F

FOLD OUT OF FIGURE 8

LOCATION OF NOISE MONITORS



Location of Noise Monitors

Bolt Beranek and Newman Inc.

21120 VANOWEN STREET CANOGA PARK, CA 91303 (818) 347-8360

Report No. 5547

ATTITUDINAL SURVEY OF TEST TO AMEND DEPARTURE PATHS AT WASHINGTON NATIONAL AIRPORT

Sanford Fidell
Richard Horonjeff
Sherri Teffeteller
Suyeo Tomooka

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The contents do not necessarily reflect official views or policy of the United States Department of Transportation.

Submitted to:

Metropolitan Washington Council of Governments
1875 Eye Street, N.W.
Washington, D.C. 20006

Original Submission: May 1984
Revised Submission: September 1984

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I. INTRODUCTION AND SUMMARY

The attitudinal survey described in this report was undertaken as part of the "scatter plan test": an evaluation of the effects of changes in flight tracks for air transport aircraft departing Washington National Airport (DCA). For a prolonged period prior to the scatter plan test, the prescribed flight tracks of aircraft departing DCA followed the Potomac River approximately ten miles to the north and at least five miles to the south before turning onto eventual course headings. Turbojet aircraft were permitted to turn from the Potomac River corridor toward their destinations at approximately 2.2 nautical miles to the North and 4 nautical miles to the South from the airport during the scatter plan test (24 October, 1983 to 7 January, 1984). Changes in noise exposure associated with this operational change are not described in this report.

The purpose of the survey was to collect information that would assist policy makers to evaluate community reaction to the changes in noise exposure produced by the scatter plan test. This was accomplished by conducting interviews with representative samples of adult household residents in eleven geographically distinct neighborhoods. The focus of interviewing was aircraft noise-induced annoyance.

A complete description of the goals, designs, and methods of the social survey was presented on 28 September 1983 to a technical

committee convened by the Metropolitan Washington Council of Governments. This information is reproduced in Appendix A of this report. FAA and its consultant retained exclusive responsibility for the design and conduct of all physical measurements of aircraft noise exposure throughout the scatter plan test.

About 200 telephone interviews were conducted at eleven sites over four weekends before, during, and after the start of the scatter plan test. The central questions of the brief interview concerned annoyance with aircraft noise exposure in the week, month, and year prior to interviewing. Several changes in the prevalance of annoyance due to aircraft noise exposure were observed at various sites and times of interviewing. Developing the information necessary to associate these changes with changes in aircraft noise exposure was the responsibility of other agencies involved in the scatter plan test.

II. METHOD

A. Selection of Interviewing Sites

Figure 1 shows the approximate locations of the eleven sites at which interviewing was conducted during the course of the scatter plan test. The census tract and block designations for the sites are tabulated in Appendix B. These sites were selected for a variety of reasons, including the following:

1) anticipated patterns of aircraft noise exposure (whether increases, decreases, or constant exposure) during the scatter plan test;

2) proximity to either permanent or anticipated noise measurement points;

3) absence of high level non-aircraft noise exposure;

4) suitability for telephone interviewing; and

5) geographic dispersion.

All other things being equal, preference in site selection was given to sites expected to experience larger changes in aircraft

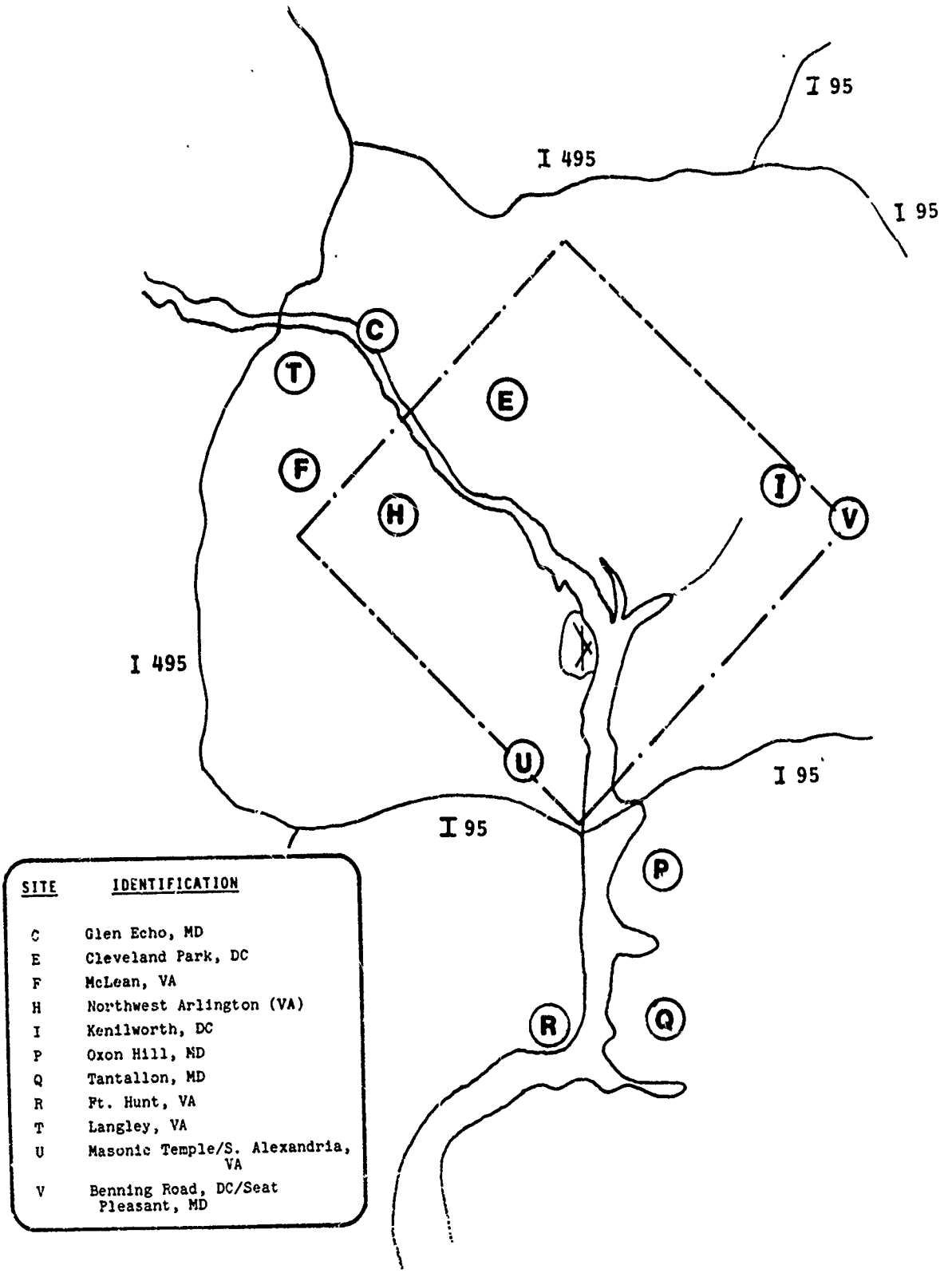


FIGURE 1. LOCATIONS OF INTERVIEWING SITES

noise exposure; sites at which changes in aircraft noise exposure could be quantified and verified; sites at which aircraft noise was noticeable to residents; sites at which non-aircraft noise was expected to remain constant during the course of the scatter plan test; sites at which residential telephone subscription was nearly universal; sites of homogeneous residential housing patterns; and sites in differing political jurisdictions.

The expected pattern of noise exposure was derived from aircraft noise exposure contours prepared by FAA. The locations of anticipated noise measurement points were also specified by FAA. Evaluation and interpretation of this information yielded a set of potential interviewing sites which included four sites at which aircraft noise exposure was expected to increase during the scatter plan test, six sites at which aircraft noise exposure was expected to decrease during the scatter plan test, and one site at which aircraft noise exposure was not expected to change appreciably.

Each of these sites was visited prior to final site selection to assess population density, residential patterns, homogeneity of noise exposure, ambient noise levels, and the adequacy of maps and sampling frames.

B. Sampling

Two hundred completed interviews were desired for each site in each round of interviews. This sample size was selected to yield a worst case 95% confidence interval no greater than ±7% for the central annoyance questions.

Current editions of street address telephone directories were used as sampling frames. Numbers of residential telephones were counted within each site's boundaries, and sampling ratios calculated such that random samples of approximately 500 names could be drawn independently (to the extent possible) for each of the four rounds of interviews. Actual sampling was accomplished by drawing every nth name (from a different random starting point) for each round of interviews at each site.

Interview forms with potential respondents' names, addresses and telephone numbers were then divided into as many subsets as there were interviewers for each round of interviews (approximately two dozen). Each subset provided to an interviewer contained roughly equal numbers of potential respondents from each site. Interviewers were instructed to solicit one interview per household from an English speaking, adult household resident.

C. Questionnaire

Most of the closed response category items on the Questionnaire (Figure C-1) were selected from interviews administered in prior aircraft noise annoyance surveys. The initial item was intended principally to verify that the party answering the telephone was indeed an English-speaking household resident. Item two sought an overall indication of neighborhood satisfaction, an attitude potentially related to changes in aircraft noise exposure. Item three, concerning annoyance due to street traffic noise, was included for calibration purposes. There is little controversy about the customary response to this question, which has been documented in many social surveys conducted worldwide. Furthermore, it was expected that the prevalence of annoyance due to street traffic noise would not change over the course of the scatter plan. Item four sought a specific rating of neighborhood noisiness, without regard to noise source.

The next three items addressed the issue of greatest interest, the prevalence of aircraft noise induced annoyance. In keeping with prior practice, the measure of annoyance was the percentage of respondents describing themselves as highly annoyed ("very" or "extremely" on a five category scale that also included the categories "not at all", "slightly", and "moderately" annoyed. Prevalence of annoyance was assessed

in three time periods during each round of interviews: the week (item five), month (item six), and year (item seven) preceding each round of interviews.

Item eight sought information about the frequency of notice of aircraft overflights. Item nine was included to permit assessment of seasonal effects on reactions to aircraft noise exposure. Item ten was included to provide a context for concerns about air traffic safety and aircraft noise exposure. The final item was included to provide evidence about activity interference due to aircraft noise exposure.

D. Interviewing

Training manuals were prepared to familiarize interviewers with the interview protocol, to define all terms, to aid in response scoring, and to provide other information to interviewers. Training (and/or retraining) sessions were held for several hours prior to each round of interviews. A BBN interviewing supervisor explained all questionnaire items and interviewing procedures during these sessions. All interviewers practiced administering the interview and responding to and scoring the questionnaire before starting to call. Telephone interviewing was conducted under central supervision from a single calling facility.

The four rounds of interviews were administered on the weekends of 14-17 October, 1983, 11-14 November, 1983, 9-12 December, 1983, and 30 March-2 April, 1984. Calling began mid-afternoon on Fridays, and continued over the weekend until an initial attempt and, if necessary, four follow-up calls (spaced a minimum of three hours apart) had been made to each potential respondent.

III. RESULTS

The narrative presentation of results in this section follows the organization of the questionnaire. Additional tables are contained in Appendix D as noted in the text. The relationship between the findings of this social survey and aircraft noise exposure is not developed in this report, as this was the responsibility of other agencies involved in the scatter plan test.

A. Disposition of Contact Attempts

Interviewing was undertaken at all eleven sites during rounds 1-3. During round 4, no interviewing was undertaken at the two sites (I - Kenilworth, D.C, and V - Benning Road, DC/Seat Pleasant, MD) at which changes in the prevalance of annoyance were smallest during the preceding three rounds of interviews. The total number of interviews completed during the course of all four rounds was 9783: 2526 in round 1, 2631 in round 2, 2667 in round 3, and 1959 in round 4. The tables in Appendix D provide an account of the statistics of interviewing.

B. Method of Analysis of Questionnaire Items

All questionnaire items (with the exception of Item 1) required a category scale rating by the respondent. That is, respondents were asked to indicate the intensity of their opinion on each

questionnaire item by selecting the one term which best described their viewpoint. For example, questions regarding annoyance required respondents to select one of five categories of annoyance (not-at-all, slightly, moderately, very, and extremely) to quantify their response.

The method recommended by Schultz (1982) was used to determine the prevalence of some consequential degree of annoyance among respondents. This method provides a readily interpretable single number rating which can be compared easily across populations, and has been used extensively in prior studies of this sort (Schultz, 1978). Responses to questions regarding annoyance were summarized by the proportion of respondents who selected either of the two most intense category scale ratings ("very" or "extremely").

As a result, the task of determining whether the prevalence of annoyance due to aircraft noise exposure differed meaningfully among sites or rounds of interviews reduced to a test of the statistical significance of the difference of sample proportions. As applied in the following subsections, this test determined whether a difference was unlikely (odds of less than 1 in 20) to have arisen by chance alone.

C. Responses to Item 1 (Duration of Residence)

Figure 2 shows the distributions of duration of residence averaged over sites for all rounds of interviews. Overall, about 86 percent of the respondents reported residency greater than 2 years, a period of time more than adequate to develop meaningful impressions of the effects of aircraft noise exposure in a neighborhood.

D. Responses to Item 2 (Neighborhood Satisfaction)

Figure 3 shows how neighborhood satisfaction was rated at each interviewing site during each round of interviews. Although neighborhood satisfaction varied from one interview site to another, no large differences were observed between single interview rounds and averages across all four interview rounds at any particular site. Only at Site Q (Tantallon, MD) was one of the differences (between round 1 and the mean of all four rounds) unlikely to have arisen by chance alone.

E. Responses to Item 3 (Annoyance due to Street Traffic Noise)

Figure 4 shows the percentage of respondents highly annoyed by street traffic noise throughout the four rounds of interviews. Not surprisingly, significant differences among neighborhoods were observed. This outcome is most likely a consequence of differences in street traffic noise associated with the range in population densities and numbers of thoroughfares within site boundaries.

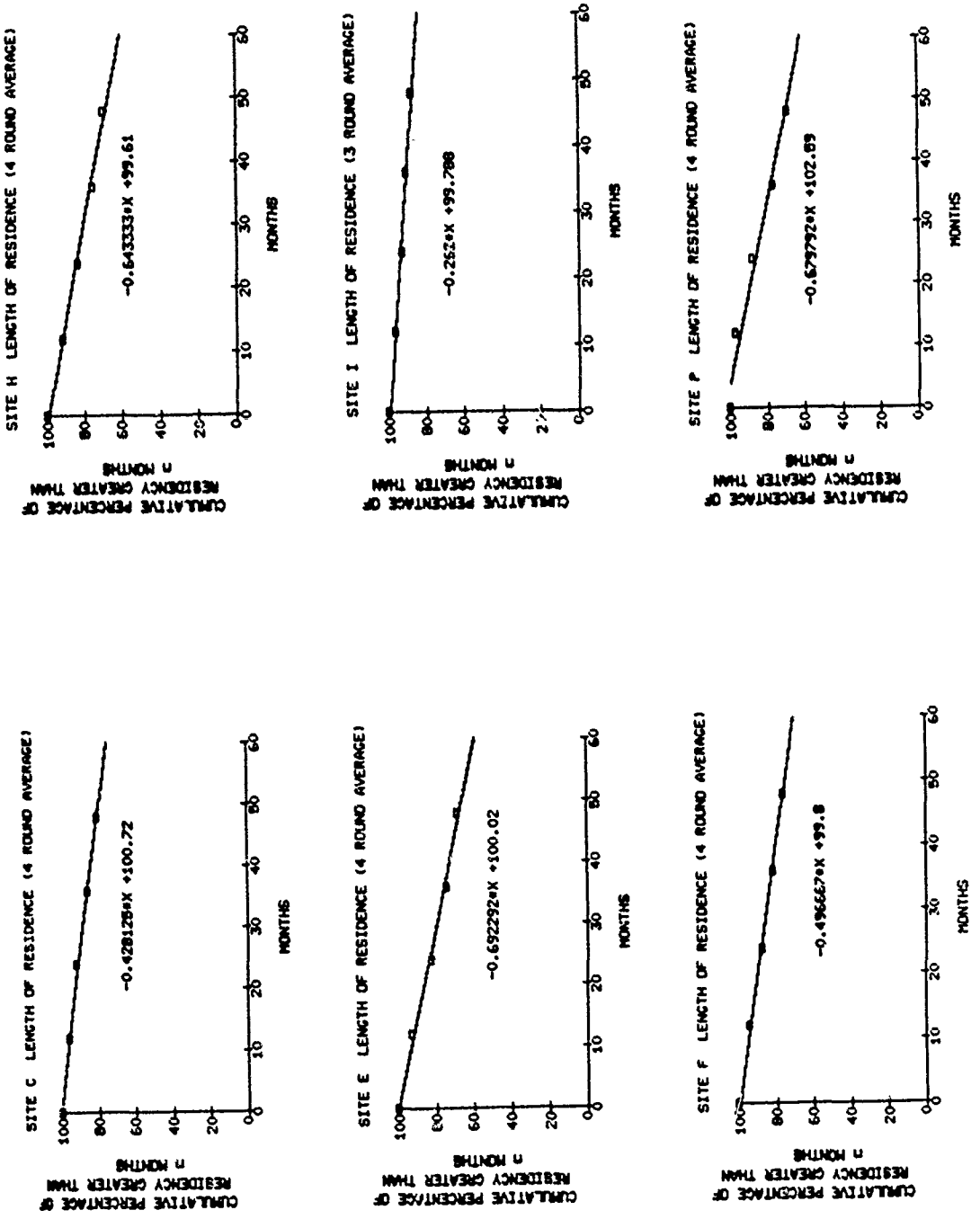


FIGURE 2. RESPONDENT LENGTH OF RESIDENCE BY SITE ACROSS ALL INTERVIEW ROUNDS

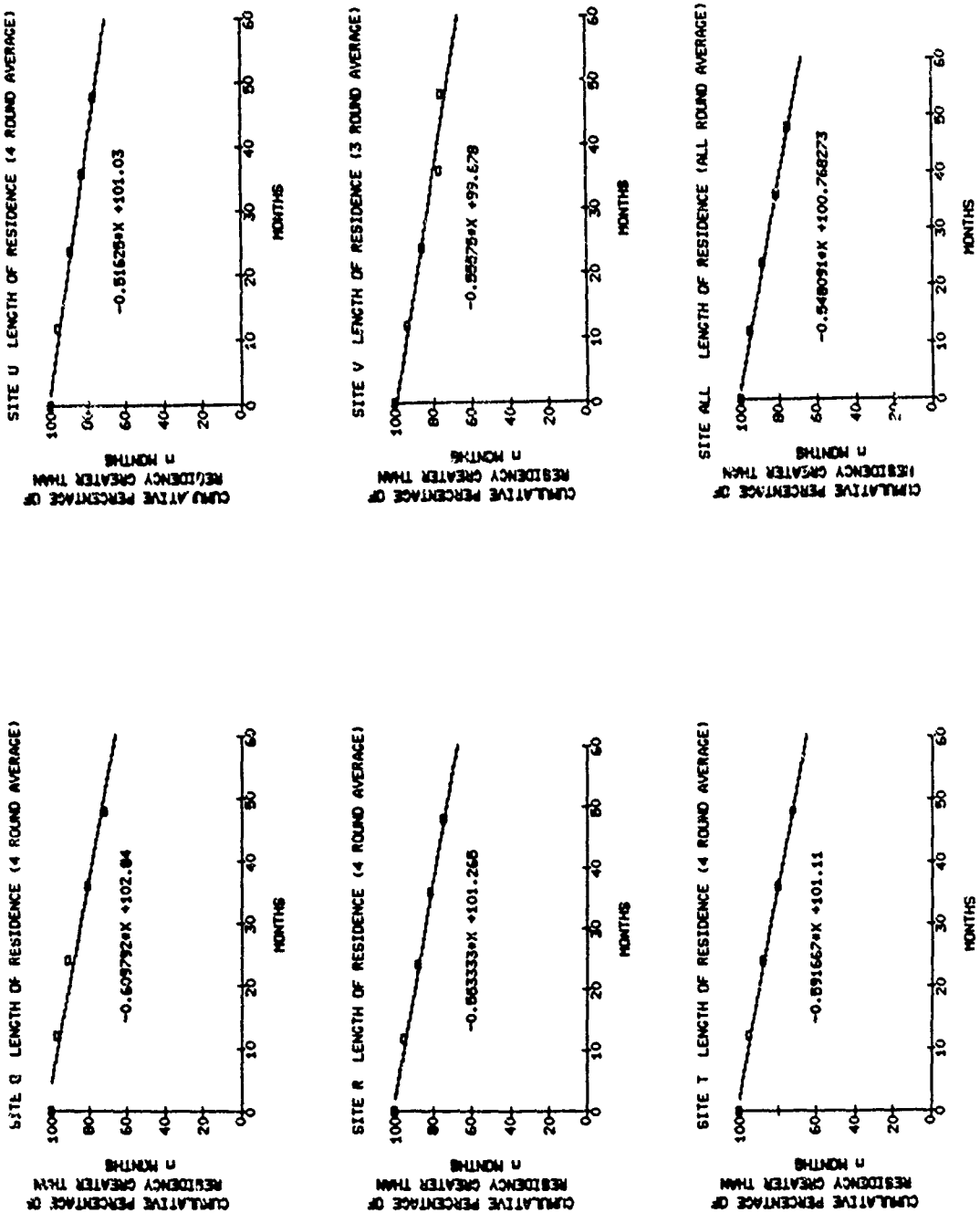


FIGURE 2. (CONTINUED)

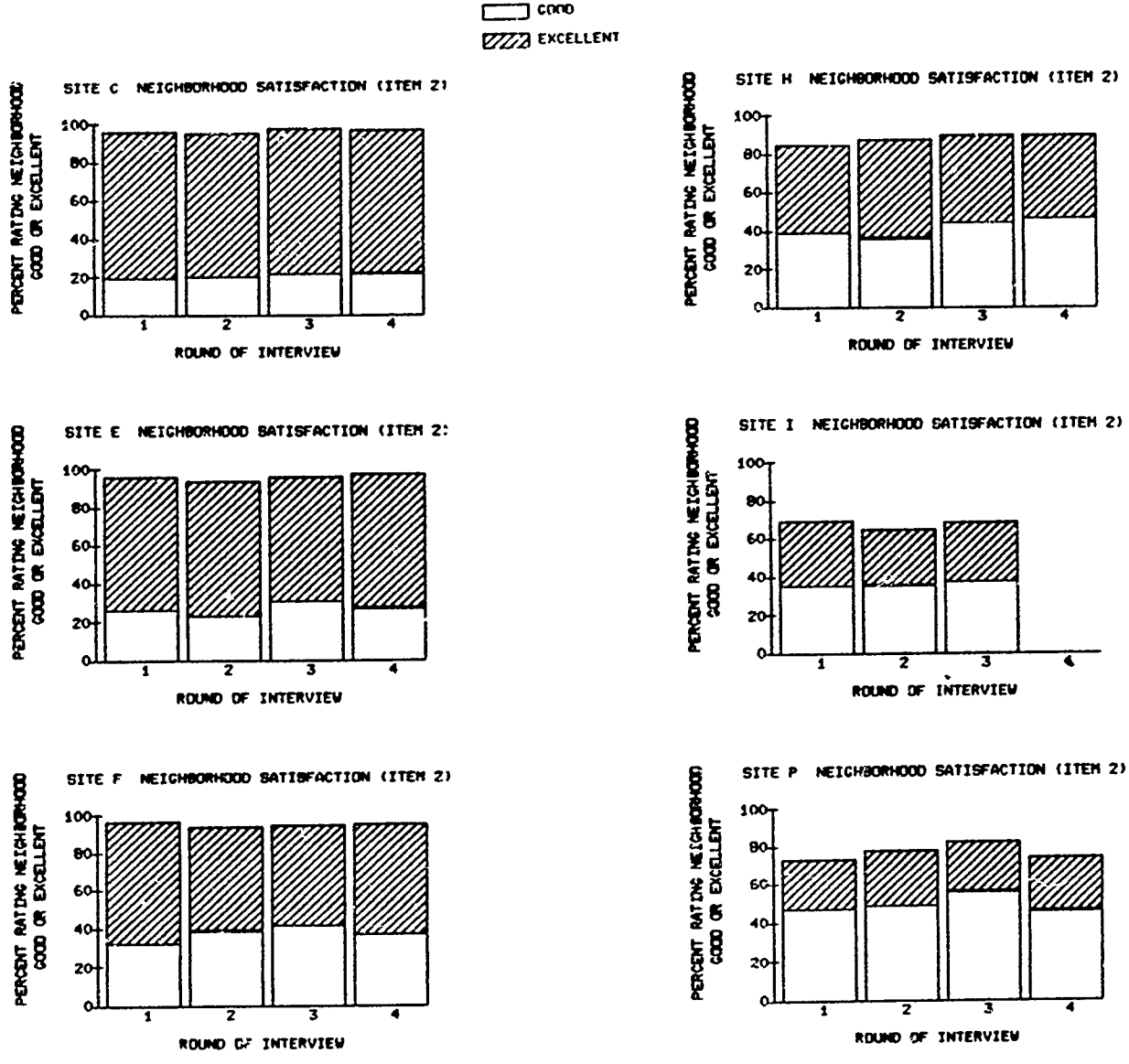


FIGURE 3. PERCENTAGES OF RESPONDENTS BY INTERVIEWING SITE AND ROUND RATING THEIR NEIGHBORHOODS AS GOOD OR EXCELLENT PLACES TO LIVE.

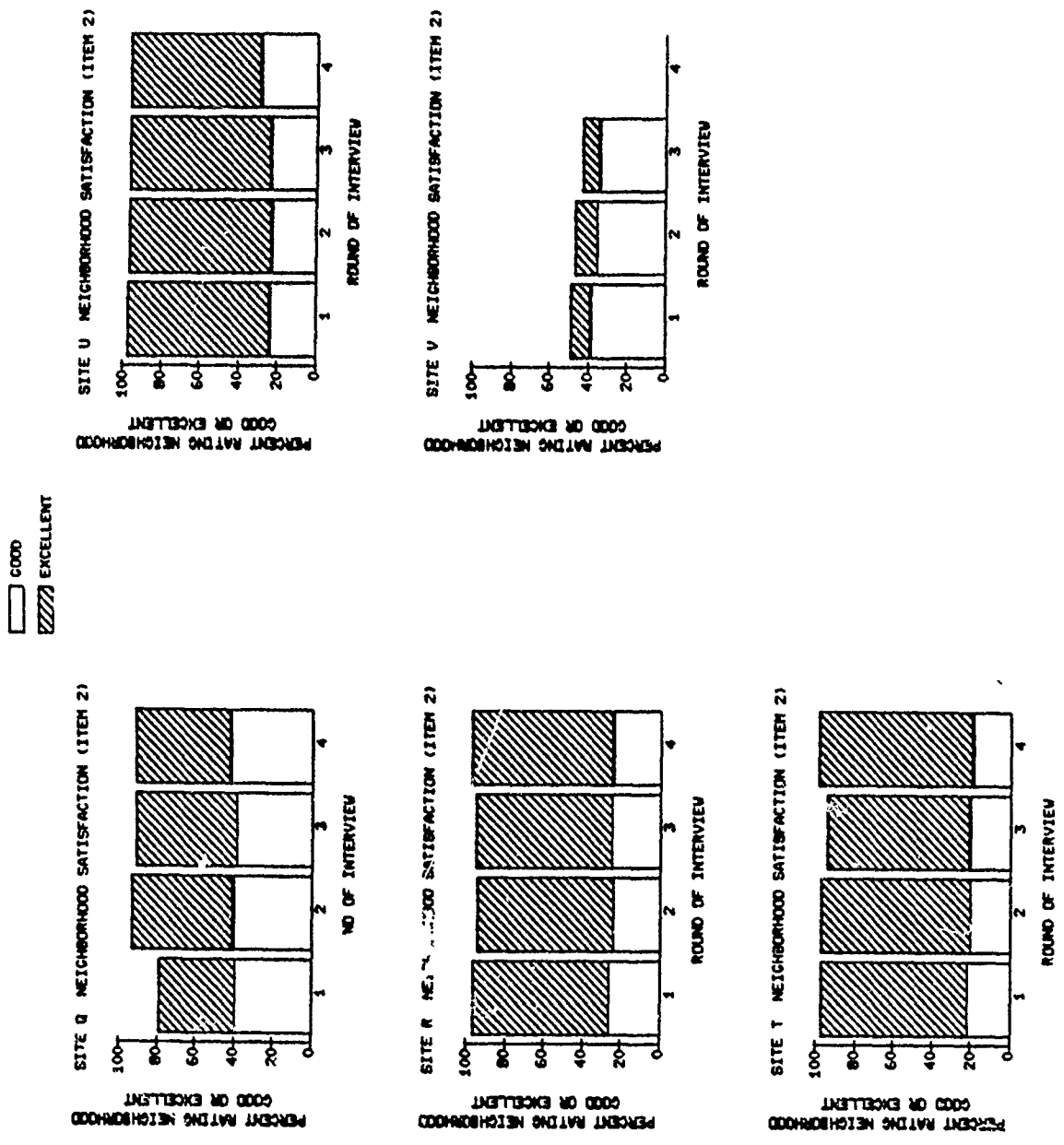


FIGURE 3. (CONTINUED)

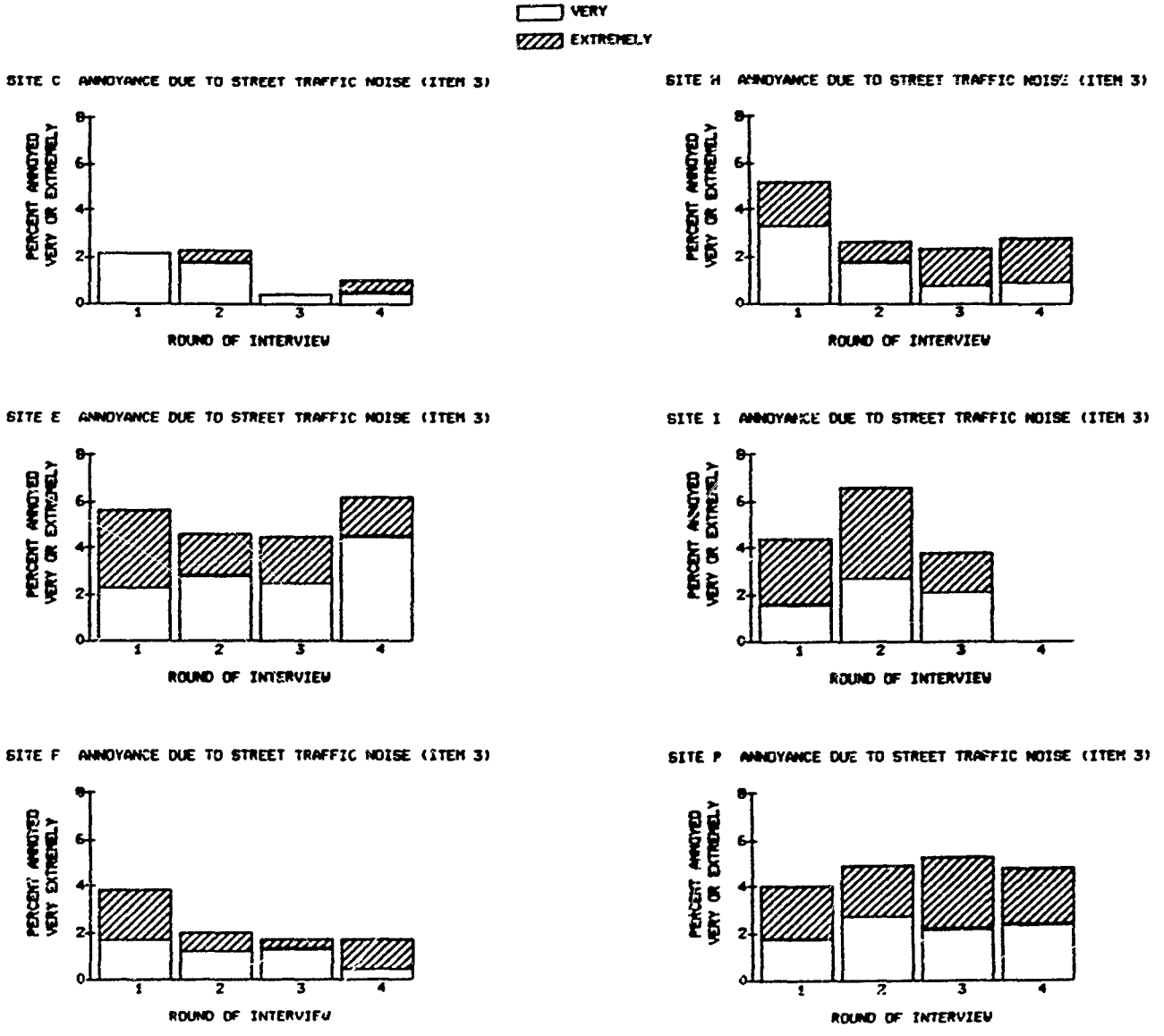


FIGURE 4. PERCENTAGES OF RESPONDENTS BY INTERVIEWING SITE AND ROUND HIGHLY ANNOYED BY STREET TRAFFIC NOISE IN WEEK PRECEDING INTERVIEW

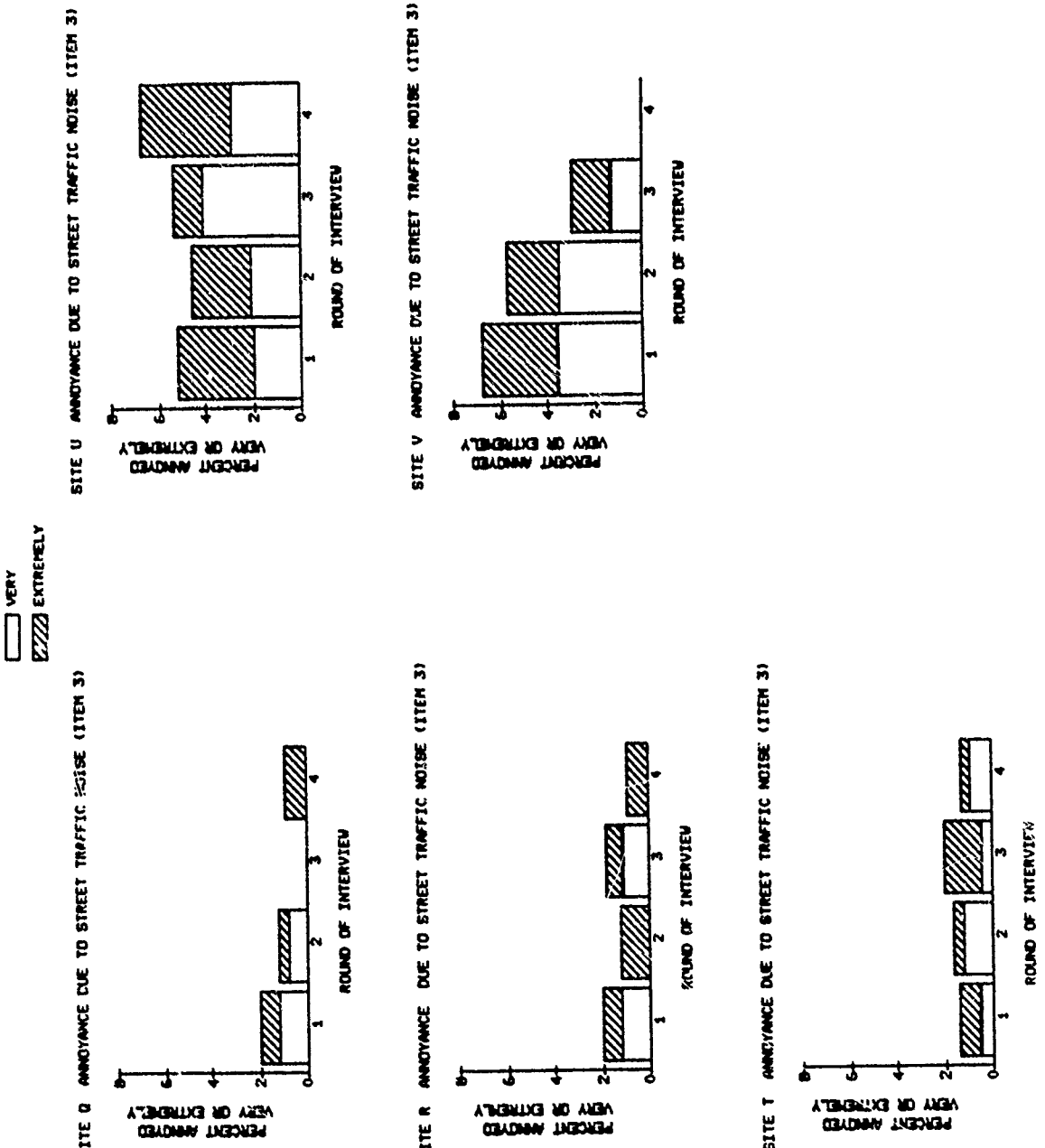


FIGURE 4. (CONTINUED)

Although the graphic presentations may in some instances suggest trends or round-to-round differences within sites, the magnitudes of the observed differences were not large enough at any site to attain statistical significance.

F. Responses to Item 4 (Neighborhood Rating)

The percentages of respondents describing their neighborhoods as noisy are displayed in Figure 5 and in Table 1. Once again, no significant differences among rounds within any one site were observed.

G. Responses to Items 5, 6, and 7 (Aircraft noise annoyance in three time periods)

Percentages of respondents at each site describing themselves as highly annoyed by aircraft noise are displayed in Figures 6, 7 and 8 for the week, month, and year prior to each round of interviews at each site. Table 2 displays the entire response distribution for these questions. Table 3 displays the proportions highly annoyed and fiduciary limits for the 95% confidence intervals for these proportions. The confidence interval calculations incorporate finite population corrections.

The most direct evidence of scatter plan effects is contained in responses to questionnaire items 5 and 6 (noise annoyance during the past week and past month). Analyses of both items 5 and 6

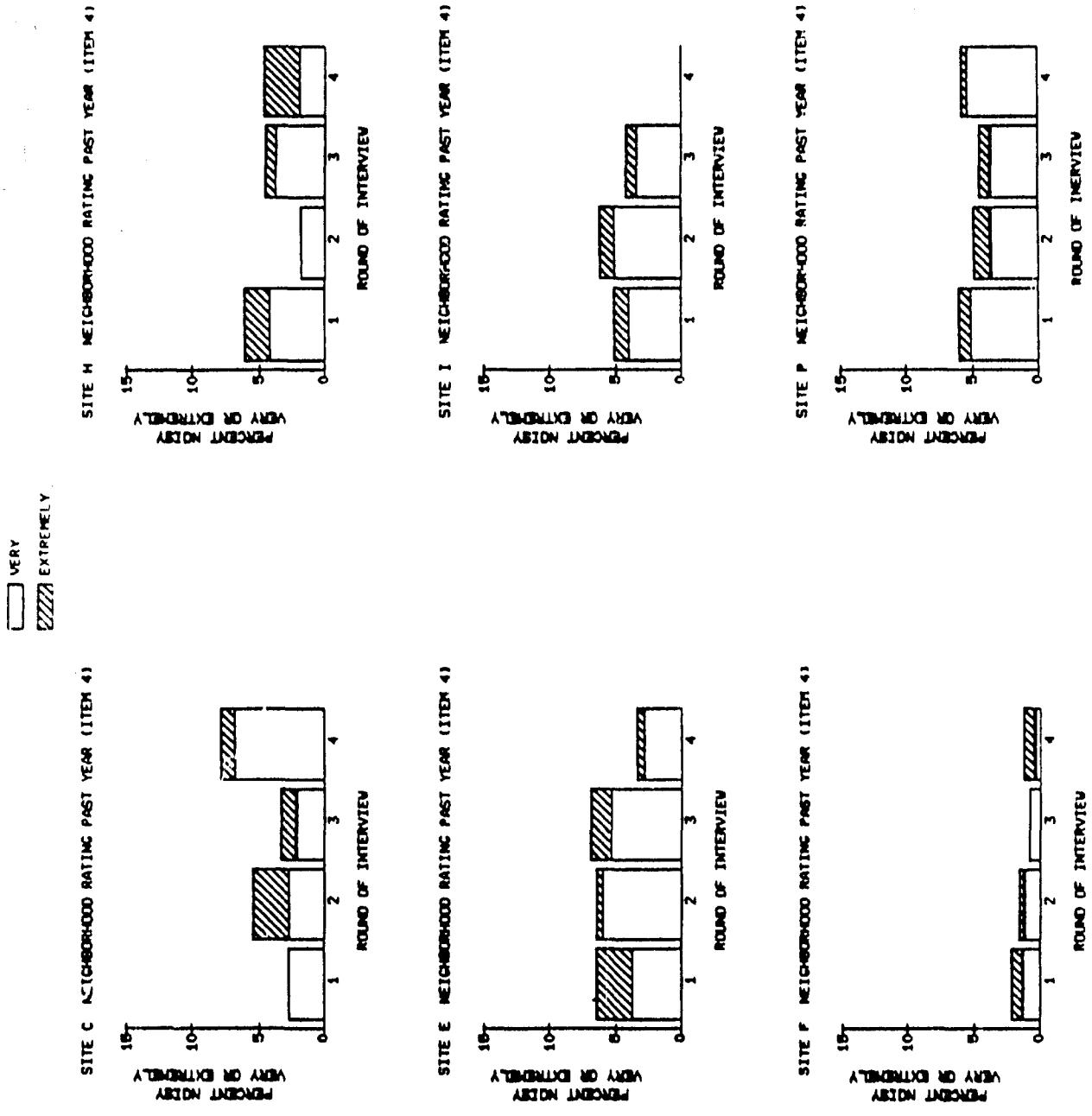


FIGURE 5. PERCENTAGES OF RESPONDENTS BY INTERVIEWING SITE AND ROUND DESCRIBING THEIR NEIGHBORHOODS AS VERY OR EXTREMELY NOISY

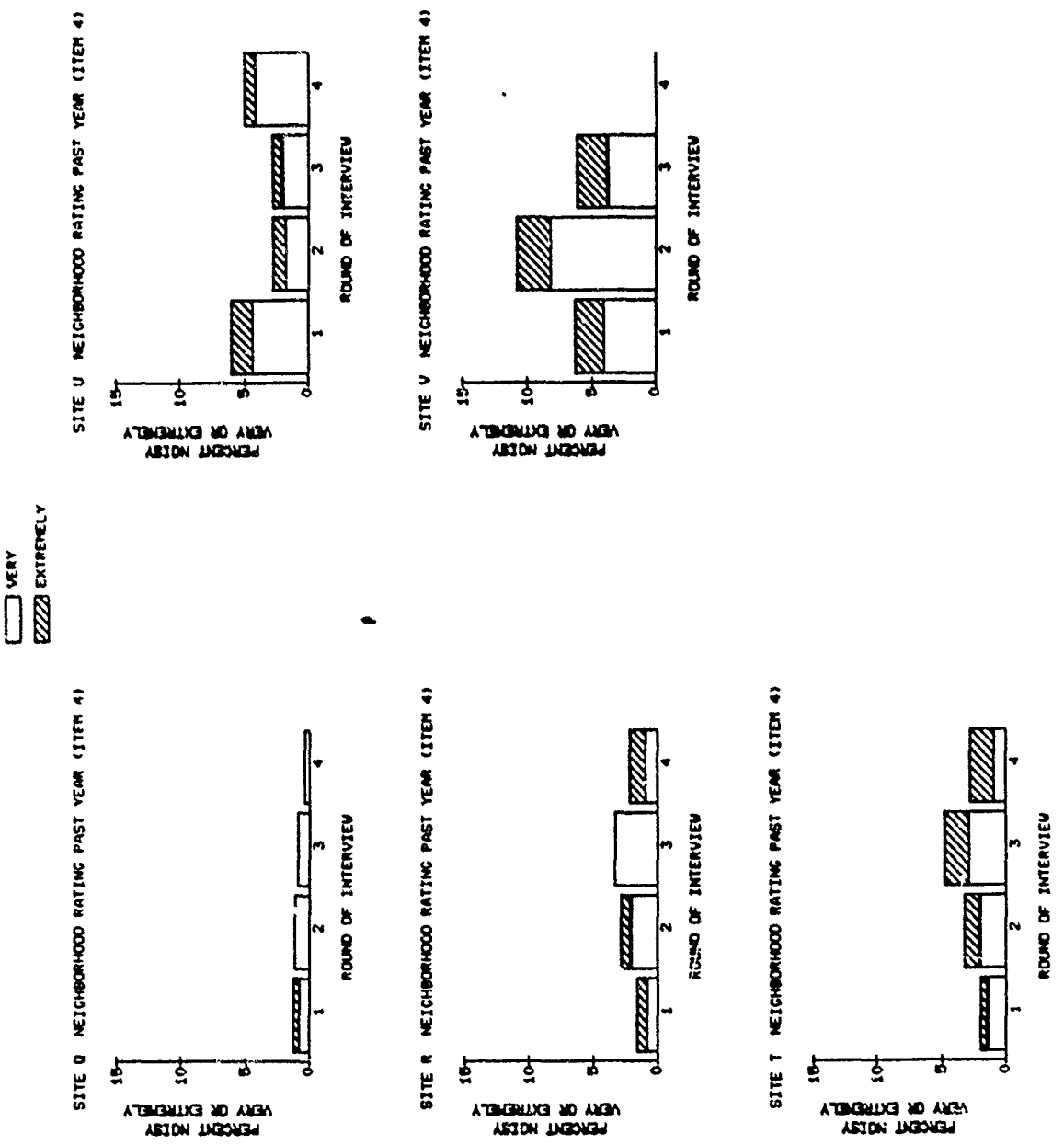


FIGURE 5. (CONTINUED)

TABLE 1. DISTRIBUTION OF RESPONSES (IN PERCENTAGE) TO ITEM 4 (NEIGHBORHOOD RATING)

SITE	EQ	VQ	MQ	SQ	SN	MN	VN	EN	DK NA REF
Glen Echo, MD (C)									
Before	10.2	33.6	38.5	7.1	1.8	2.7	2.7	0.0	3.4
During	8.2	35.0	35.9	6.8	1.8	4.1	2.7	2.7	2.8
During	6.2	35.8	37.4	6.6	0.4	5.3	2.1	1.2	5.0
After	6.8	30.8	40.8	4.9	1.5	4.9	6.8	1.0	2.5
Cleveland Park, DC (E)									
Before	4.2	21.4	40.5	7.0	2.3	12.6	3.7	2.8	5.8
During	6.5	22.6	36.4	6.5	6.5	8.8	6.0	0.5	6.2
During	4.5	23.4	38.9	6.6	2.5	12.3	5.3	1.6	4.9
After	7.3	20.7	44.7	6.7	5.0	10.6	2.8	0.6	1.6
McLean, VA (F)									
Before	8.9	30.5	42.4	6.4	1.7	5.5	1.3	0.8	2.5
During	4.7	33.5	45.3	7.5	2.0	3.5	1.2	0.4	1.9
During	10.1	30.4	42.6	7.6	1.7	2.1	0.8	0.0	4.7
After	4.8	35.0	43.2	7.9	2.2	3.9	0.4	0.9	0.9
Northwest Arlington, VA (H)									
Before	4.7	29.0	43.0	6.5	3.3	5.1	4.2	1.9	2.3
During	6.3	25.9	46.0	9.8	2.2	5.4	1.8	0.0	2.6
During	4.9	28.4	43.2	5.8	2.9	4.9	3.7	0.8	5.4
After	4.2	26.3	40.8	7.0	5.2	7.5	1.9	2.8	4.3

SITE	EQ	VQ	MQ	SQ	SN	MN	VN	EN	DK NA REF
Kenilworth, DC (I)									
Before	10.4	23.7	34.1	8.4	4.8	8.8	4.0	1.2	4.6
During	9.8	23.8	30.9	10.9	6.6	5.9	5.1	1.2	5.8
During	10.5	22.3	35.3	11.8	8.0	4.2	3.4	0.8	3.7
Oxon Hill, MD (P)									
Before	4.6	24.0	39.2	9.2	2.8	12.0	5.1	0.9	2.2
During	7.2	21.1	44.4	11.2	2.7	6.3	3.6	1.3	2.2
During	9.4	25.4	46.0	7.1	1.3	3.6	3.6	0.9	2.7
After	5.8	22.6	38.9	11.5	2.9	10.6	5.3	0.5	1.9
Tantallon, MD (Q)									
Before	11.5	31.7	42.4	8.2	1.6	2.5	0.8	0.4	0.9
During	12.4	37.3	33.6	6.6	2.9	3.7	1.2	0.0	2.3
During	13.2	35.0	39.7	6.0	0.4	3.4	0.9	0.0	1.4
After	12.6	29.9	44.2	6.5	0.9	2.9	0.4	0.0	1.6
Fort Hunt VA (R)									
Before	2.9	29.6	50.8	6.7	1.2	2.5	0.8	0.8	4.7
During	10.2	32.6	44.1	4.7	0.4	4.2	2.1	0.8	0.9
During	11.7	30.3	42.7	4.4	1.5	3.6	3.3	0.0	2.5
After	5.6	30.2	48.7	6.5	0.9	3.9	0.9	1.3	2.0

NOTE: EQ=EXTREMELY QUIET; VQ=VERY QUIET; MQ=MODERATELY QUIET; SQ=SLIGHTLY QUIET; SN=SLIGHTLY NOISY; MN=MODERATELY NOISY; VN=VERY NOISY; EN=EXTREMELY NOISY; DK=DON'T KNOW; REF=REFUSED; NA=NOT ASCERTAINED

TABLE 1. (CONT'D)

SITE	EQ	VQ	MQ	SQ	SN	MN	VN	EN	DK NA REF
Langley, VA (T)									
Before	13.3	39.0	32.6	3.3	0.9	2.3	1.4	0.5	1.7
During	10.5	35.5	38.7	6.5	1.2	3.6	2.0	1.2	0.8
During	11.2	36.3	39.8	2.8	1.2	1.6	2.8	2.0	2.3
After	11.2	40.8	34.1	5.8	1.8	2.2	0.9	1.8	1.4
Masonic Temple S. Alexandria, VA (U)									
Before	7.3	32.7	40.7	5.6	1.2	3.6	4.4	1.6	2.9
During	8.5	31.3	39.1	5.0	2.5	8.2	1.8	1.1	2.5
During	10.7	28.4	43.2	7.0	1.6	4.1	2.1	0.8	2.1
After	6.3	22.7	46.6	6.3	2.9	7.6	4.2	0.8	2.6
Benning Road, DC/Seat Pleasant MD (V)									
Before	5.9	19.1	27.3	14.1	9.5	11.8	4.1	2.3	5.9
During	4.4	17.9	33.6	14.0	5.2	9.6	8.3	2.6	4.4
During	5.5	16.1	36.4	14.8	7.2	7.6	3.8	2.5	6.1

NOTE: EQ=EXTREMELY QUIET; VQ=VERY QUIET; MQ=MODERATELY QUIET; SQ=SLIGHTLY QUIET; SN=SLIGHTLY NOISY; MN=MODERATELY NOISY; VN=VERY NOISY; EN=EXTREMELY NOISY; DK=DON'T KNOW; REF=REFUSED; NA=NOT ASCERTAINED

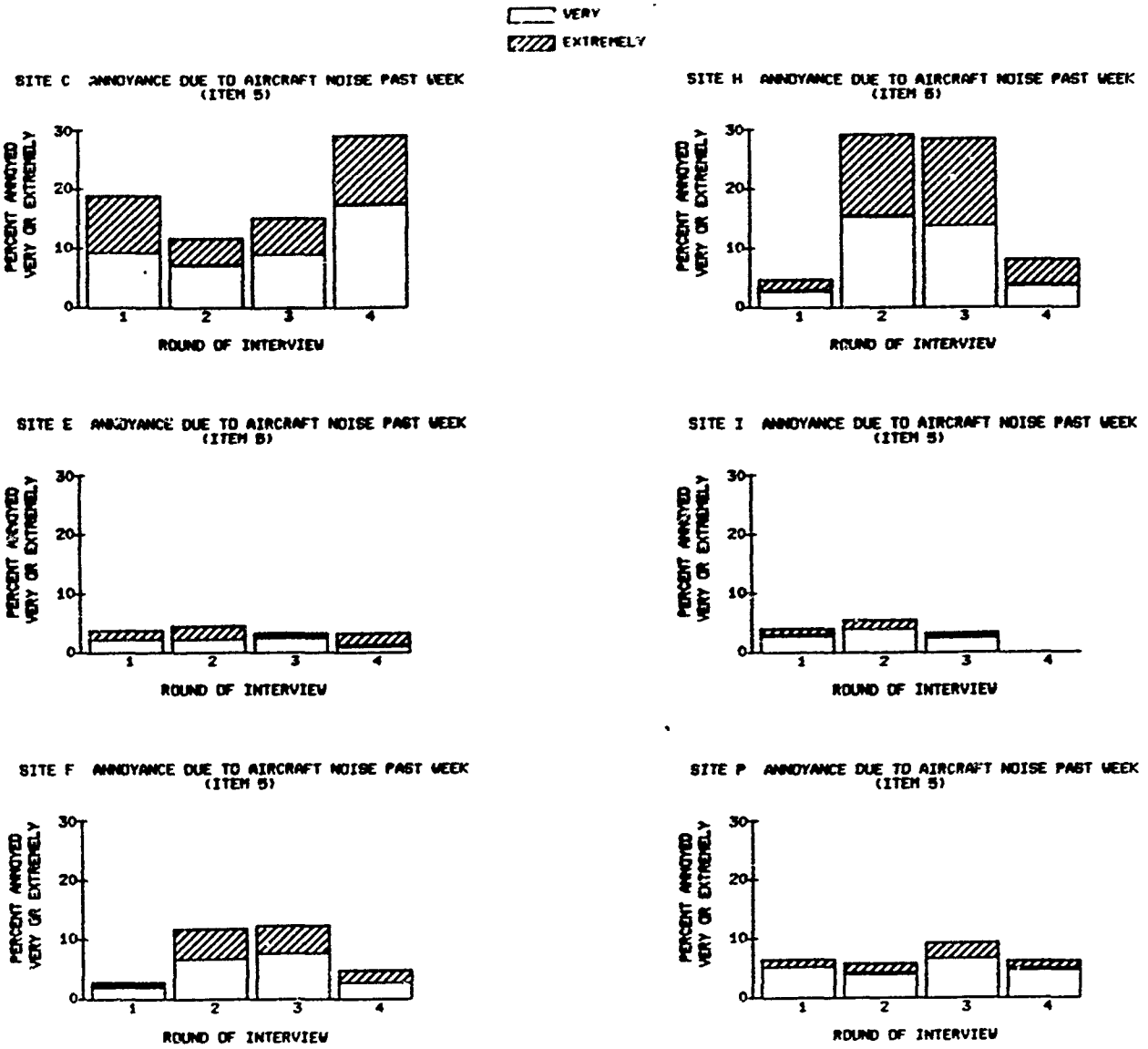


FIGURE 6. PERCENTAGES OF RESPONDENTS BY INTERVIEWING SITE AND ROUND HIGHLY ANNOYED BY AIRCRAFT NOISE IN WEEK PRECEDING INTERVIEW

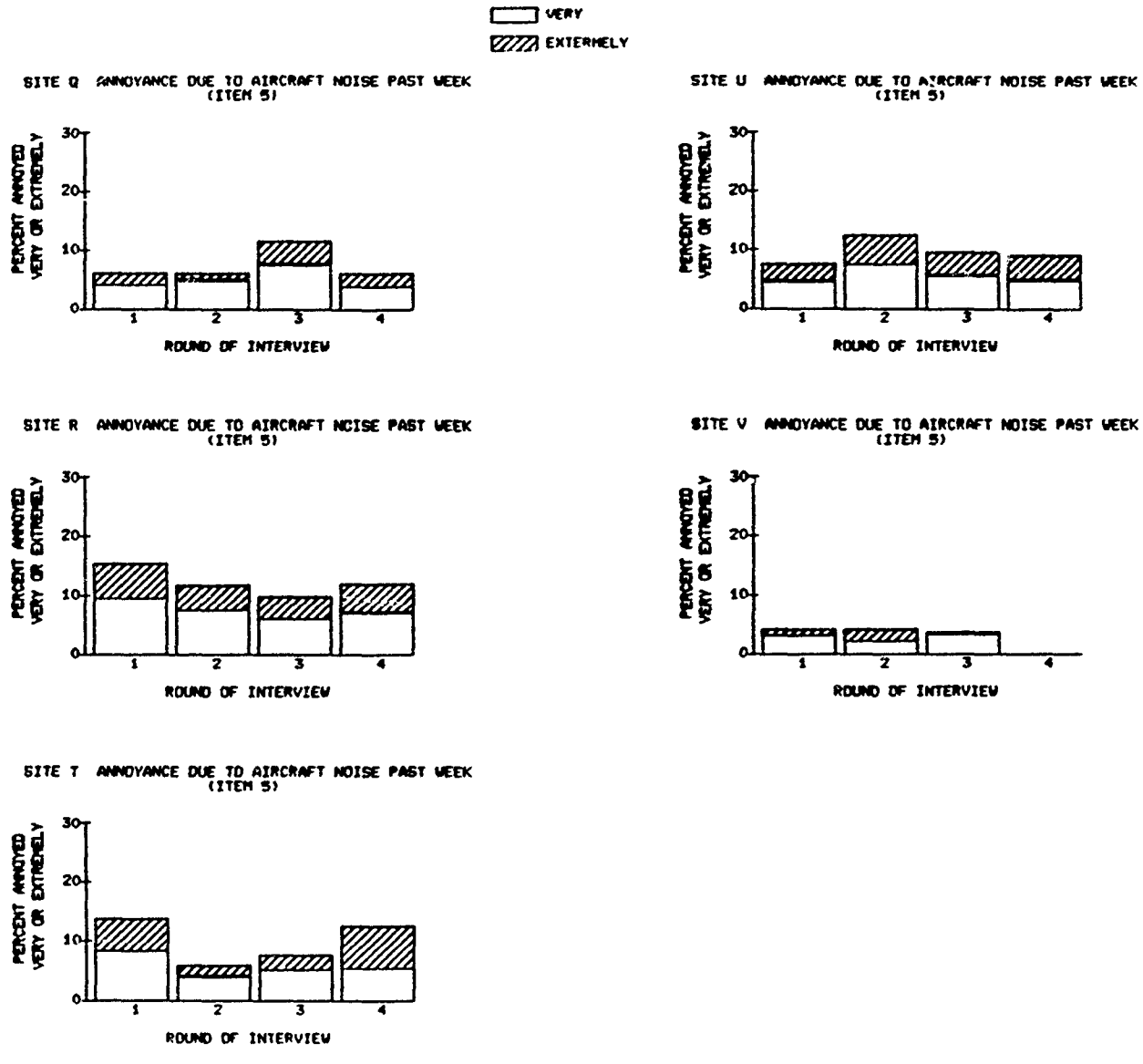


FIGURE 6. (CONTINUED)

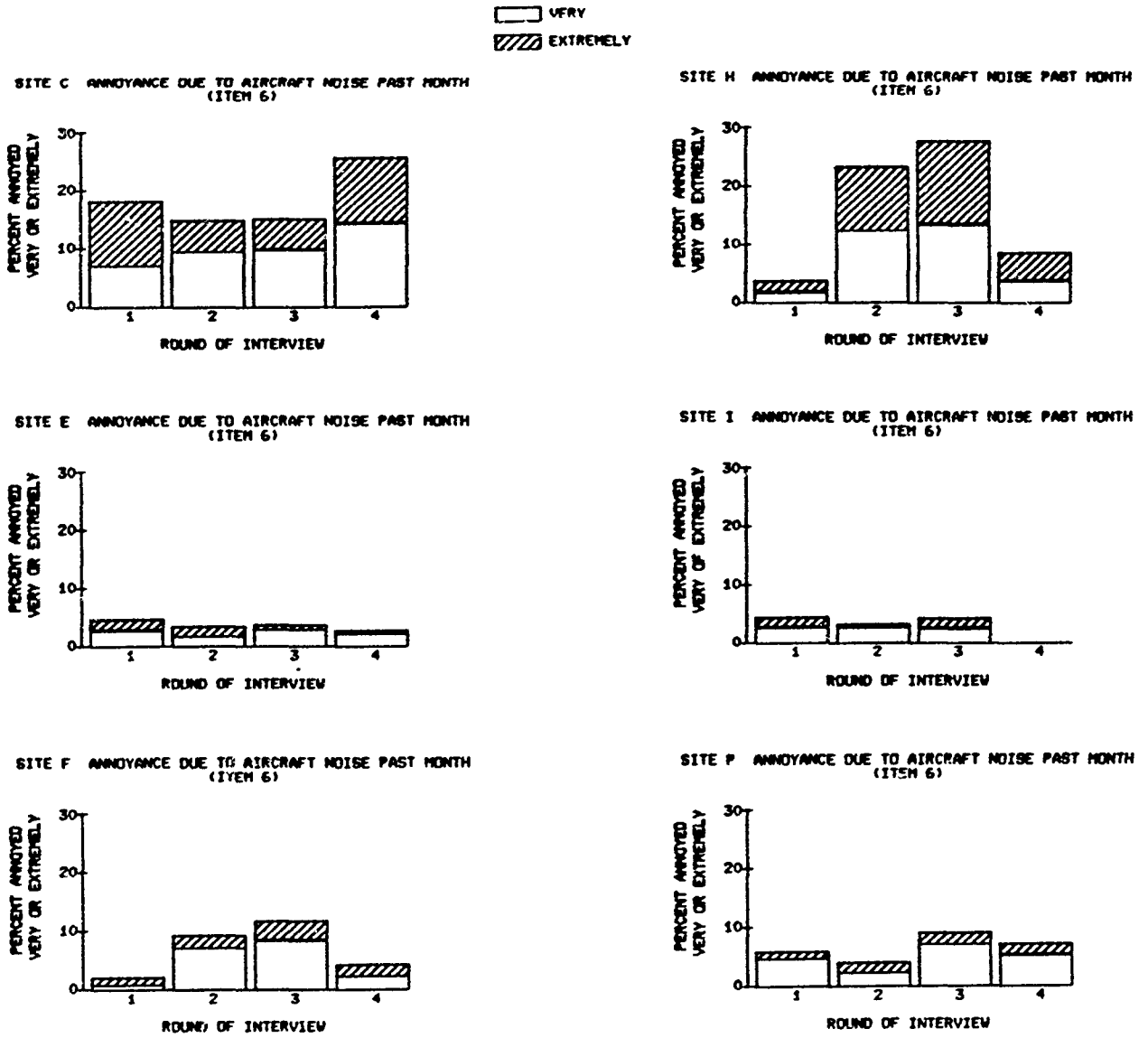


FIGURE 7. PERCENTAGES OF RESPONDENTS BY INTERVIEWING SITE AND ROUND HIGHLY ANNOYED BY AIRCRAFT NOISE IN MONTH PRECEDING INTERVIEW

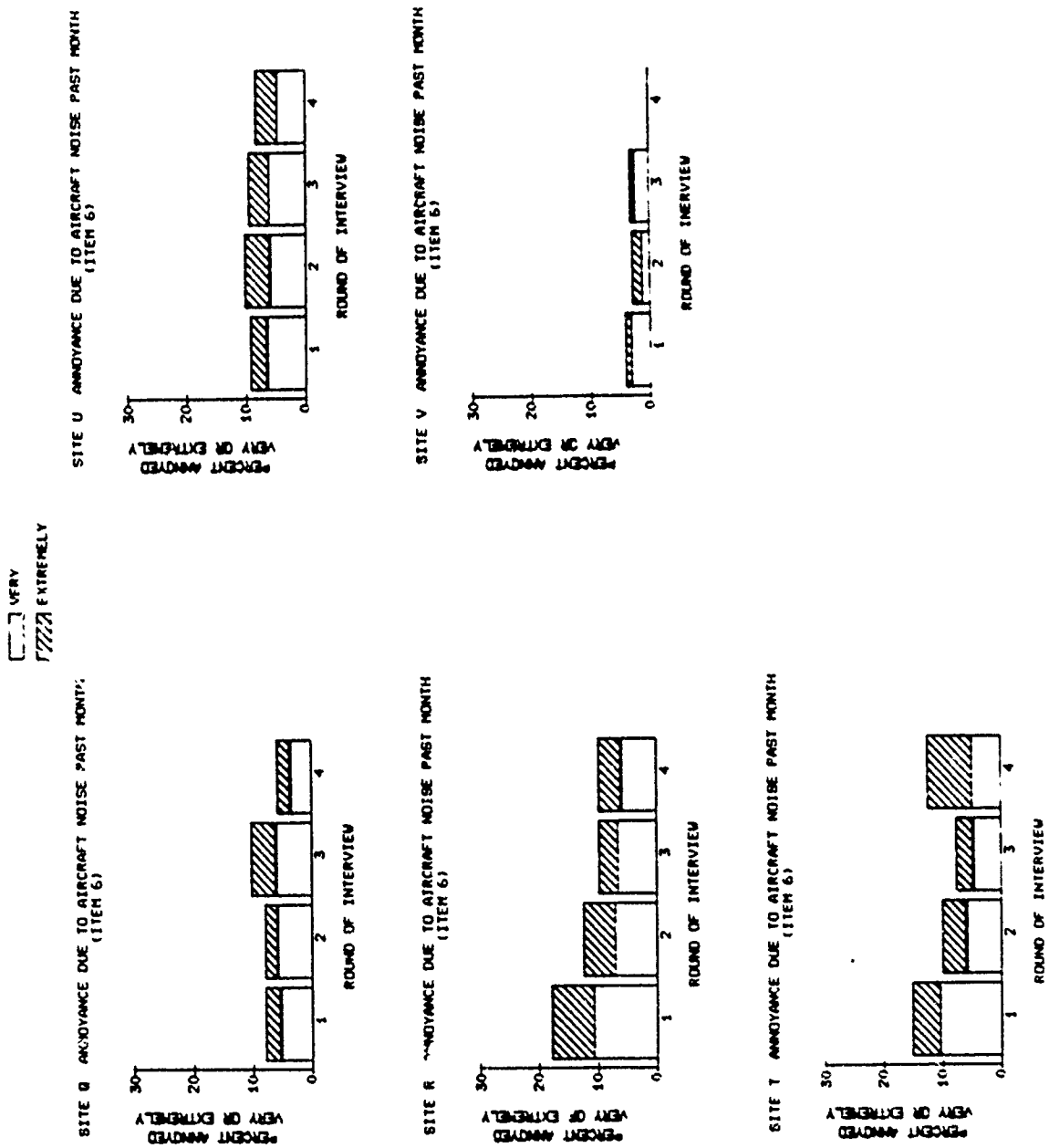


FIGURE 7. (CONTINUED)

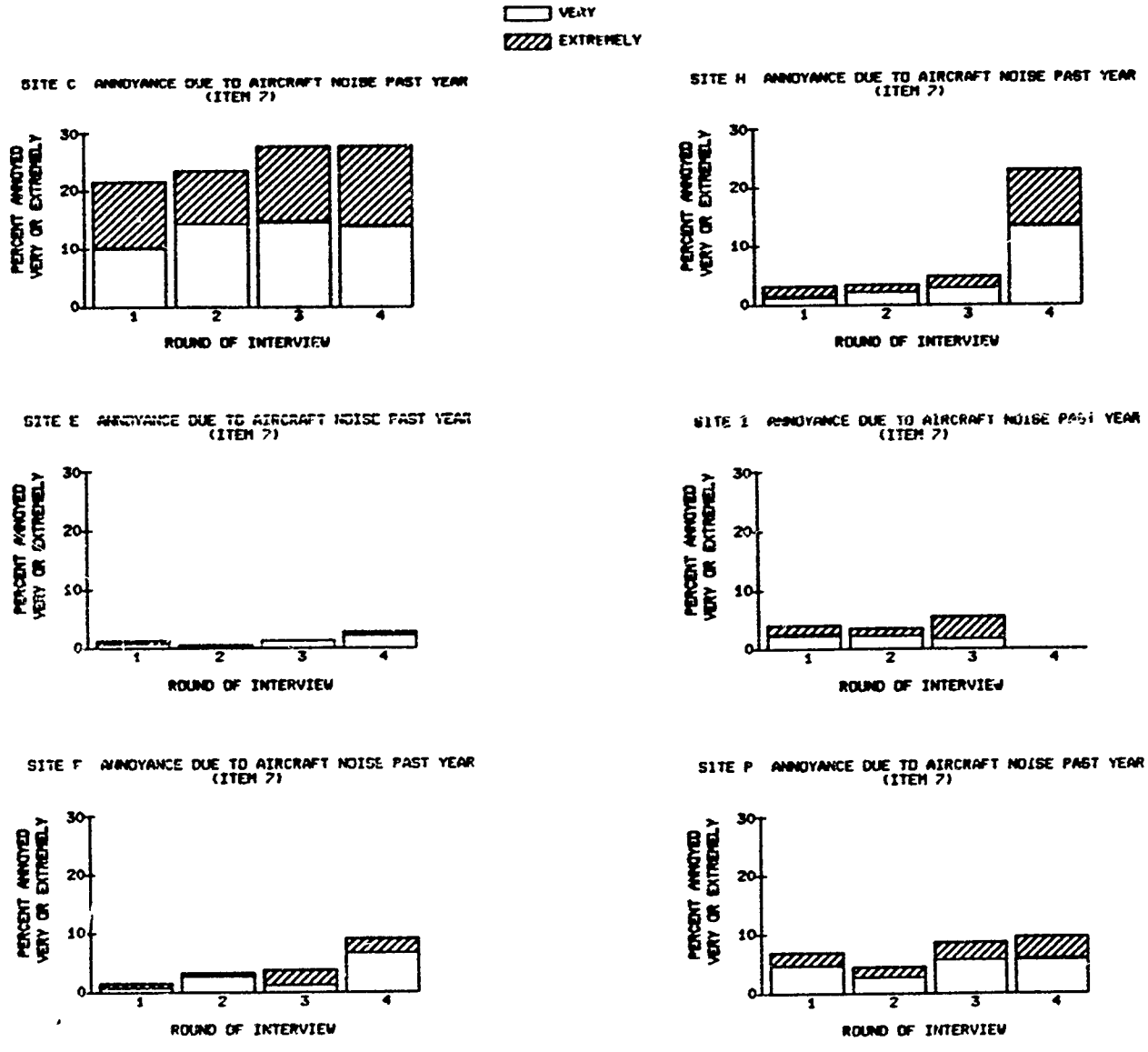


FIGURE 8. PERCENTAGES OF RESPONDENTS BY INTERVIEWING SITE AND ROUND HIGHLY ANNOYED BY AIRCRAFT NOISE IN YEAR PRECEDING INTERVIEW

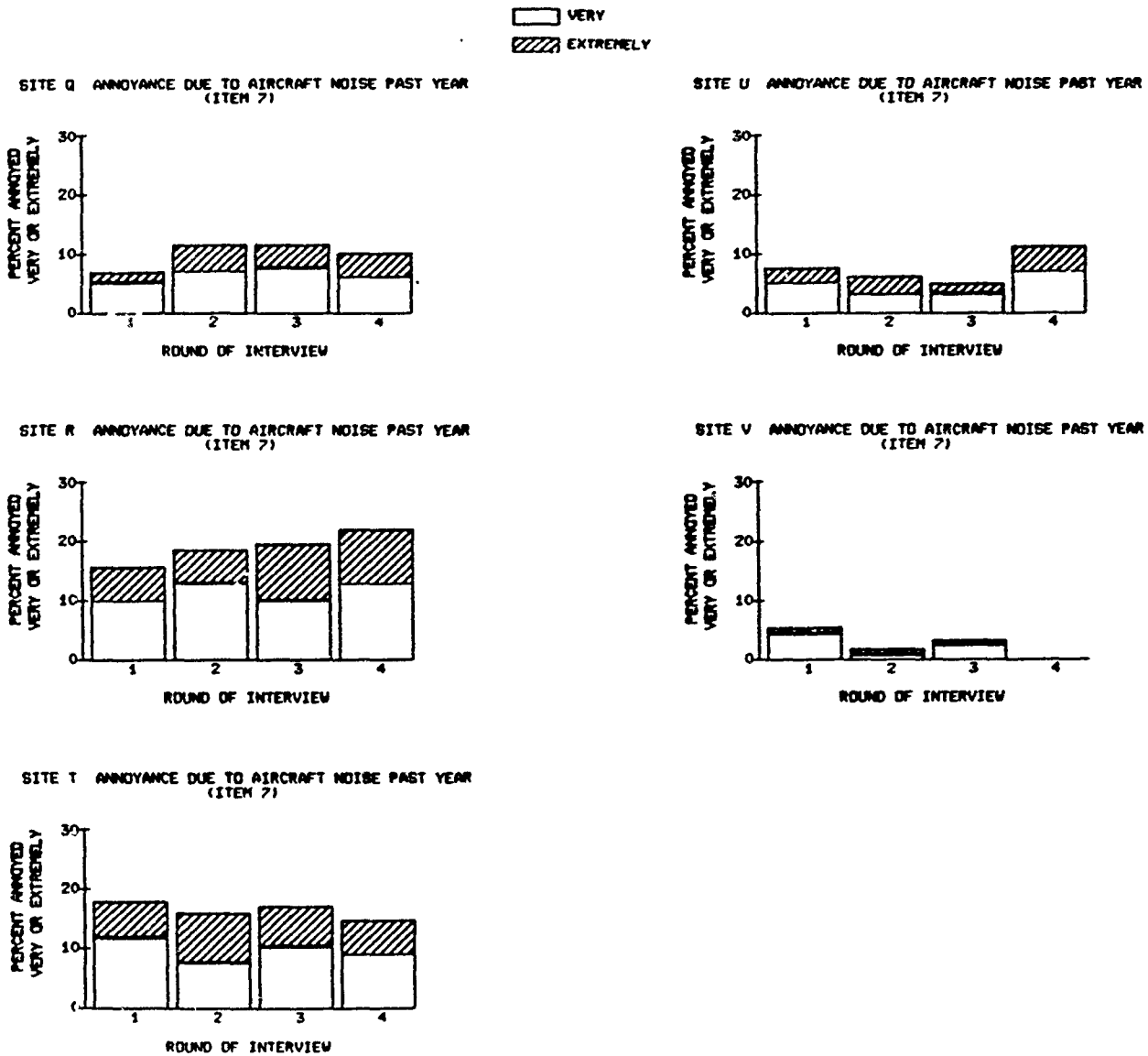


FIGURE 8. (CONTINUED)

TABLE 2. TABULATION OF ANNOYANCE DUE TO AIRCRAFT NOISE FOR THREE TIME PERIODS AT EACH SITE

SITE	'WEEK' NAA	SA	MA	VA	EA	DK NAA REF	'MONTH' NAA	SA	MA	VA	EA	DK NAA REF	'YEAR' NAA	SA	MA	VA	EA	DK NAA REF
Glen Echo, Md. (C)																		
Before	53.1	8.0	16.8	9.3	9.7	3.1	45.6	11.5	21.2	7.1	11.1	3.5	42.9	12.4	20.4	10.2	11.5	2.6
During	62.7	5.9	18.2	7.3	4.5	1.4	55.0	10.9	15.9	9.5	5.5	3.2	44.1	9.5	20.5	14.5	9.1	2.3
During	56.8	11.9	15.2	9.1	6.2	0.8	51.0	16.5	15.2	9.9	5.3	2.1	40.3	14.0	16.0	14.8	12.8	2.1
After	45.1	6.5	16.9	17.5	11.7	0.8	41.3	8.3	22.3	14.6	11.2	2.3	32.0	13.1	22.3	14.1	13.6	4.9
Cleveland Park, DC (E)																		
Before	80.5	5.1	7.9	2.3	1.4	2.8	80.5	7.9	5.6	2.8	1.9	1.3	77.2	14.0	5.1	0.9	0.5	2.3
During	73.7	11.1	8.8	2.3	2.3	1.8	74.7	12.9	6.5	1.8	1.8	2.3	73.3	16.0	4.1	0.5	0.0	4.1
During	75.0	10.2	10.7	2.5	0.8	0.8	67.2	14.8	12.7	2.9	0.8	1.6	74.6	14.8	7.0	1.2	0.0	2.4
After	82.7	8.9	3.9	1.1	2.2	1.2	79.9	10.6	5.6	2.2	0.6	1.1	75.4	14.0	7.3	2.2	0.6	0.5
McLean, VA. (F)																		
Before	78.4	11.4	4.7	2.1	0.8	2.6	78.4	11.4	5.9	0.8	1.3	2.2	75.8	14.8	4.7	0.8	0.8	3.1
During	57.9	10.2	19.3	6.7	5.1	0.8	63.0	12.6	12.6	7.1	2.4	2.3	73.6	13.8	7.9	2.8	0.4	1.5
During	62.9	8.9	15.6	7.6	4.6	0.4	60.3	12.2	15.2	6.4	3.4	0.5	76.8	13.9	3.8	1.3	2.5	1.7
After	80.8	6.1	6.6	2.6	2.2	1.7	72.5	9.6	10.0	2.2	2.2	3.5	55.5	16.6	17.0	6.6	2.6	1.7
Northwest Arlington, VA (H)																		
Before	84.1	6.1	4.2	2.8	1.9	0.9	78.5	9.3	6.1	1.9	1.9	2.3	68.2	17.3	7.9	1.4	1.9	3.3
During	35.7	10.7	21.9	15.6	13.8	2.3	42.9	9.8	19.6	12.5	10.7	4.5	77.7	10.7	4.9	2.2	1.3	3.2
During	42.8	9.1	16.5	14.0	14.8	0.8	41.2	9.9	19.3	13.6	14.6	2.0	69.5	13.6	7.8	2.9	2.1	4.1
After	75.1	7.5	8.6	3.8	4.2	1.4	63.8	14.1	10.3	3.8	4.7	3.3	45.1	14.1	16.0	13.6	9.4	1.8

NOTE: NAA=NOT AT ALL ANNOYED; SA=SLIGHTLY ANNOYED; MA=MODERATELY ANNOYED; VA=VERY ANNOYED; EA=EXTREMELY ANNOYED; DK=DON'T KNOW; NAA=NOT APPLICABLE; REF=REFUSE

TABLE 2. (CONT'D)

SITE	'WEEK'						'MONTH'						'YEAR'					
	NAA	SA	MA	VA	EA	DK NAA REF	NAA	SA	MA	VA	EA	DK NAA REF	NAA	SA	MA	VA	EA	DK NAA REF
Kenilworth, DC (I)																		
Before	78.3	10.8	4.8	2.8	1.2	2.1	75.9	10.0	6.4	2.8	1.6	[illegible]3	72.7	13.7	6.8	2.4	1.6	2.8
During	80.9	8.6	4.7	3.9	1.6	0.3	81.3	8.6	5.1	2.7	0.4	1 9	80.1	8.2	6.6	2.3	1.2	1.6
During	86.1	5.0	5.0	2.5	0.8	0.6	80.3	6.3	8.0	2.5	1.7	1.[illegible]	74.4	11.3	7.6	1.7	3.8	1.2
Oxon Hill, MD (P)																		
Before	68.2	12.4	11.5	5.1	1.4	1.4	68.2	12.4	10.6	4.6	1.4	2.8	61.8	17.5	10.6	4.6	2.3	3.2
During	72.2	13.0	8.1	4.0	1.8	0.9	77.6	12.1	5.8	2.2	1.8	0.5	70.4	12.6	10.8	2.7	1.8	1.7
During	60.7	17.4	11.6	6.7	2.7	0.9	63.4	14.7	12.1	7.1	2.2	0.5	61.2	17.4	11.6	5.6	3.1	1.1
After	76.4	9.1	7.2	4.8	1.4	1.1	68.3	13.0	11.1	5.3	1.9	0.4	61.5	16.8	12.5	5.8	2.6	0.8
Tantallon, MD (Q)																		
Before	61.3	14.4	17.3	4.1	2.1	0.8	59.3	15.2	16.0	5.3	2.5	1.7	56.0	15.2	21.4	5.3	1.6	0.5
During	76.3	9.1	6.6	5.0	1.2	1.8	68.5	12.4	9.5	5.8	2.1	1.7	61.4	13.3	13.3	7.1	4.6	0.3
During	66.2	12.0	10.3	7.7	3.8	0.0	60.7	15.4	12.8	6.0	4.3	0.8	51.3	17.9	17.1	7.7	3.8	2.2
After	74.5	6.9	12.1	3.9	2.2	0.4	63.6	16.0	13.9	3.5	2.2	0.8	53.7	18.6	15.6	6.1	3.9	2.1
Port Hunt, VA (R)																		
Before	59.6	8.8	15.8	9.6	5.8	0.4	48.7	11.2	20.8	10.8	7.1	1.4	42.9	14.6	25.8	10.0	5.8	0.9
During	63.1	11.9	10.6	7.6	4.2	2.6	53.0	17.8	15.3	7.2	5.5	1.2	42.8	18.2	19.1	13.1	5.5	1.3
During	69.0	9.1	11.3	6.2	.6	0.8	63.9	13.1	12.4	6.6	3.3	0.7	43.4	17.9	18.6	10.2	9.5	0.4
After	55.1	8.2	19.8	7.3	.7	0.9	54.3	9.9	24.6	6.0	3.9	1.3	37.1	15.5	24.1	12.9	9.1	1.3

TABLE 2. (CONT'D)

SITE	'WEEK'						'MONTH'						'YEAR'					
	NAA	SA	MA	VA	EA	DK NAA REF	NAA	SA	MA	VA	EA	DK NAA REF	NAA	SA	MA	VA	EA	DK NAA REF
Langley, VA. (T)																		
Before	59.6	12.4	13.3	8.3	5.5	0.9	58.3	13.8	11.5	10.6	4.6	1.2	50.0	17.9	12.8	11.9	6.0	1.4
During	69.4	13.7	10.5	4.0	2.0	0.4	62.1	13.7	11.7	6.0	4.0	2.5	49.2	16.9	16.1	7.7	8.1	2.0
During	65.7	12.7	12.0	5.2	2.4	2.0	62.9	17.1	10.4	4.8	2.8	2.0	42.6	18.7	18.3	10.4	6.8	3.2
After	62.3	11.7	12.6	5.4	7.2	0.8	58.3	13.9	14.3	4.9	7.6	1.0	43.5	20.2	16.6	9.0	5.8	4.9
Masonic Temple S. Alexandria, VA (U)																		
Before	66.9	10.9	12.5	4.8	2.8	2.1	62.5	12.9	12.9	6.5	2.8	2.4	56.5	17.7	15.7	5.2	2.4	2.5
During	63.7	9.3	13.5	7.5	5.0	1.0	61.9	13.9	11.4	6.0	4.3	2.5	60.9	19.6	11.4	3.2	2.8	2.1
During	71.2	9.5	8.6	5.8	3.7	1.2	64.2	13.6	11.5	6.2	3.3	1.2	63.8	17.7	11.1	3.3	1.6	2.5
After	69.3	11.8	8.8	5.0	4.2	0.9	66.4	12.6	11.8	4.6	3.8	0.8	53.4	17.2	17.2	7.1	4.2	0.9
Benning Road, DC/ Sect Pleasant, MD (V)																		
Before	85.5	5.0	3.2	3.2	0.9	2.2	85.9	5.9	3.2	3.2	0.9	1.0	76.8	10.9	4.1	4.5	0.9	2.8
During	81.2	9.2	4.8	2.2	2.2	0.4	76.9	13.5	6.1	1.3	1.7	0.5	77.3	14.0	6.1	0.9	0.9	0.8
During	83.5	8.1	4.7	3.4	0.4	0.0	79.7	10.2	5.5	2.5	0.8	1.3	76.7	10.2	5.5	2.5	0.8	4.3

TABLE 3. PROPORTIONS HIGHLY ANNOYED AND 95 PERCENT CONFIDENCE INTERVALS FOR ITEMS 5, 6, AND 7

SITE	PROPORTION 'HIGHLY ANNOYED' LAST WEEK	Fiduciary Limits*	LAST MONTH	Fiduciary Limits	LAST YEAR	Fiduciary Limits
Glen Echo, MD (C)						
Before	.190	.151-.229	.182	.144-.220	.217	.176-.258
During	.128	.094-.162	.150	.114-.186	.236	.193-.279
During	.153	.119-.187	.152	.118-.186	.276	.234-.318
After	.292	.243-.341	.258	.211-.305	.277	.229-.325
Cleveland Park, DC (E)						
Before	.037	.012-.062	.047	.019-.075	.014	.000-.029
During	.046	.019-.073	.036	.012-.060	.005	.000-.014
During	.033	.011-.055	.037	.014-.060	.012	.000-.025
After	.033	.007-.059	.028	.004-.052	.028	.004-.052
McLean, VA (F)						
Before	.039	.017-.061	.021	.005-.037	.016	.002-.030
During	.118	.083-.153	.095	.064-.126	.032	.013-.051
During	.122	.085-.159	.118	.082-.154	.038	.017-.059
After	.048	.023-.073	.004	.020-.368	.092	.059-.125
Northwest Arlington, VA (H)						
Before	.047	.020-.074	.038	.014-.062	.031	.009-.053
During	.294	.238-.350	.234	.182-.286	.035	.013-.057
During	.288	.235-.341	.276	.224-.328	.050	.024-.076
After	.080	.046-.114	.085	.050-.120	.230	.177-.283

SITE	PROPORTION 'HIGHLY ANNOYED' LAST WEEK	Fiduciary Limits*	LAST MONTH	Fiduciary Limits	LAST YEAR	Fiduciary Limits
Kenilworth, DC (I)						
Before	.030	.013-.047	.044	.024-.064	.028	.012-.044
During	.055	.033-.077	.031	.014-.048	.025	.017-.053
During	.033	.015-.051	.042	.021-.063	.055	.032-.078
Oxon Hill MD (P)						
Before	.065	.035-.095	.060	.031-.089	.069	.039-.099
During	.058	.030-.086	.040	.017-.063	.045	.020-.070
During	.094	.060-.128	.093	.059-.127	.087	.054-.120
After	.062	.032-.092	.072	.040-.104	.082	.048-.116
Tantallon, MD (Q)						
Before	.062	.040-.084	.078	.053-.103	.069	.046-.092
During	.062	.039-.085	.079	.054-.104	.117	.087-.147
During	.116	.085-.147	.103	.074-.132	.115	.084-.146
After	.061	.038-.084	.057	.035-.079	.100	.071-.129
Fort Hunt, VA (R)						
Before	.154	.115-.193	.179	.137-.221	.158	.118-.198
During	.118	.082-.154	.127	.090-.164	.186	.143-.229
During	.098	.068-.128	.099	.069-.129	.197	.158-.236
After	.120	.084-.156	.099	.066-.132	.220	.174-.266

* Fiduciary limits to 95% confidence interval on proportion highly annoyed calculated as $1.96\ (PQ/N')^{1/2}$, where P = sample proportion highly annoyed, Q = 1-P, and $N' = nN/(N-n)$, where N = total number of telephone subscribing residential households at each site and n = total number of completed interviews at each site.

TABLE 3. (CONT'D)

SITE	PROPORTION 'HIGHLY ANNOYED'					
	LAST WEEK		LAST MONTH		LAST YEAR	
Langley, VA (T)		Fiduciary Limits		Fiduciary Limits		Fiduciary Limits
Before	.138	.097-.179	.152	.109-.195	.179	.133-.225
During	.06	.034-.086	.100	.067-.133	.158	.118-.198
During	.076	.047-.105	.076	.047-.105	.172	.131-.213
After	.126	.087-.165	.125	.086-.164	.148	.106-.190
Masonic Temple S. Alexandria, VA (U)						
Before	.076	.047-.105	.093	.062-.125	.076	.047-.105
During	.125	.092-.158	.103	.073-.133	.060	.036-.084
During	.095	.063-.127	.095	.063-.127	.049	.025-.073
After	.092	.060-.124	.084	.053-.115	.113	.078-.148
Benning Road, DC/Seat Pleasant, MD (V)						
Before	.041	.019-.063	.041	.019-.063	.054	.029-.079
During	.044	.022-.066	.030	.012-.048	.018	.004-.032
During	.038	.018-.058	.033	.014-.052	.033	.014-.052

lead to near identical conclusions regarding proportions of the population highly annoyed. Table 4 indicates interview sites where significant differences may be found between the average of rounds 1 and 4 (before and after the test) and the average of rounds 2 and 3 (during the test). The most dramatic increase in annoyance during rounds 2 and 3 occurred at Site H (Northwest Arlington, VA), while the most dramatic decrease occurred at Site C (Glen Echo, MD).

Another means of assessing changes in annoyance responses is to compare the results of only rounds 1 (before) and 3 (approximately 1.5 months after test inception). Table 5 documents where significant differences between these two rounds may be found. Note that the findings of Tables 4 and 5 agree closely, the only differences being sites C (Glen Echo, MD) and R (Ft. Hunt, VA).

h. Responses to Item 8 (Frequency of Notice of Aircraft)

Figure 9 shows the percentages of respondents at each site reporting no change, increases, and decreases in numbers of aircraft noticed while at home in the weeks before each of the four rounds of interviews. Table 6 displays complete response distributions for this questionnaire item. By and large, the patterns observed in the aircraft annoyance questions (items 5 and 6) are repeated in item 8. Sites F (McLean, VA) and H (Northwest Arlington, VA), at which the prevalence of annoyance increased during rounds 2 and 3, also showed larger proportions of respondents noticing larger numbers of aircraft prior to these two rounds.

TABLE 4. OBSERVED SIGNIFICANT DIFFERENCES BETWEEN PROPORTIONS HIGHLY ANNOYED BY AIRCRAFT NOISE -- ROUNDS 1 AND 4 VS. ROUNDS 2 AND 3

SITE	IDENTIFICATION	ANNOYANCE DIFFERENCE
C	Glen Echo, MD	2 & 3 less than 1 & 4
E	Cleveland Park, DC	None
F	McLean, VA	2 & 3 greater than 1 & 4
H	Northwest Arlington, VA	2 & 3 greater than 1 & 4
I	Kenilworth, DC	None
P	Oxon Hill, MD	None
Q	Tantallon, MD	None
R	Ft. Hunt, VA	None
T	Langley, VA	2 & 3 less than 1 & 4
U	Masonic Temple/S. Alexandria,VA	None
V	Benning Road, DC/Seat Pleasant,MD	None

TABLE 5. OBSERVED SIGNIFICANT DIFFERENCES BETWEEN PROPORTIONS HIGHLY ANNOYED BY AIRCRAFT NOISE -- ROUNDS 1 AND 3

SITE	IDENTIFICATION	ANNOYANCE DIFFERENCE
C	Glen Echo, MD	None
E	Cleveland Park, DC	None
F	McLean, VA	3 greater than 1
H	Northwest Arlington, VA	3 greater than 1
I	Kenilworth, DC	None
P	Oxon Hill, MD	None
Q	Tantallon, MD	None
R	Ft. Hunt, VA	3 less than 1*
T	Langley, VA	3 less than 1
U	Masonic Temple/S. Alexandria,VA	None
V	Benning Road, DC/Seat Pleasant,MD	None

* Past month question showed significant difference; past week did not.

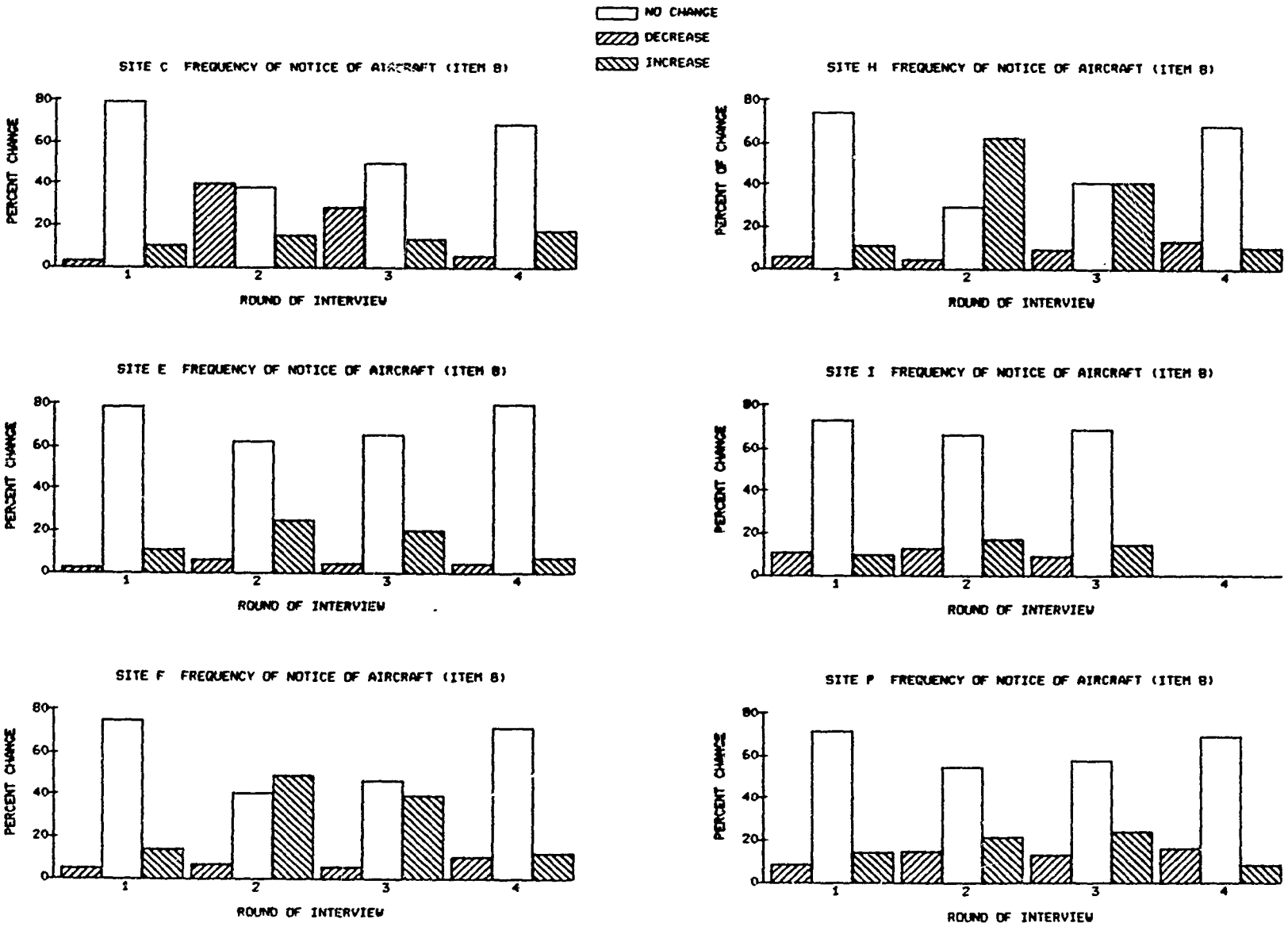


FIGURE 9. PERCENTAGES OF RESPONDENTS BY INTERVIEWING SITE AND ROUND REPORTING DECREASES, NO CHANGE, OR INCREASES IN NUMBERS OF AIRPLANES WHILE AT HOME IN WEEK PRECEDING INTERVIEW

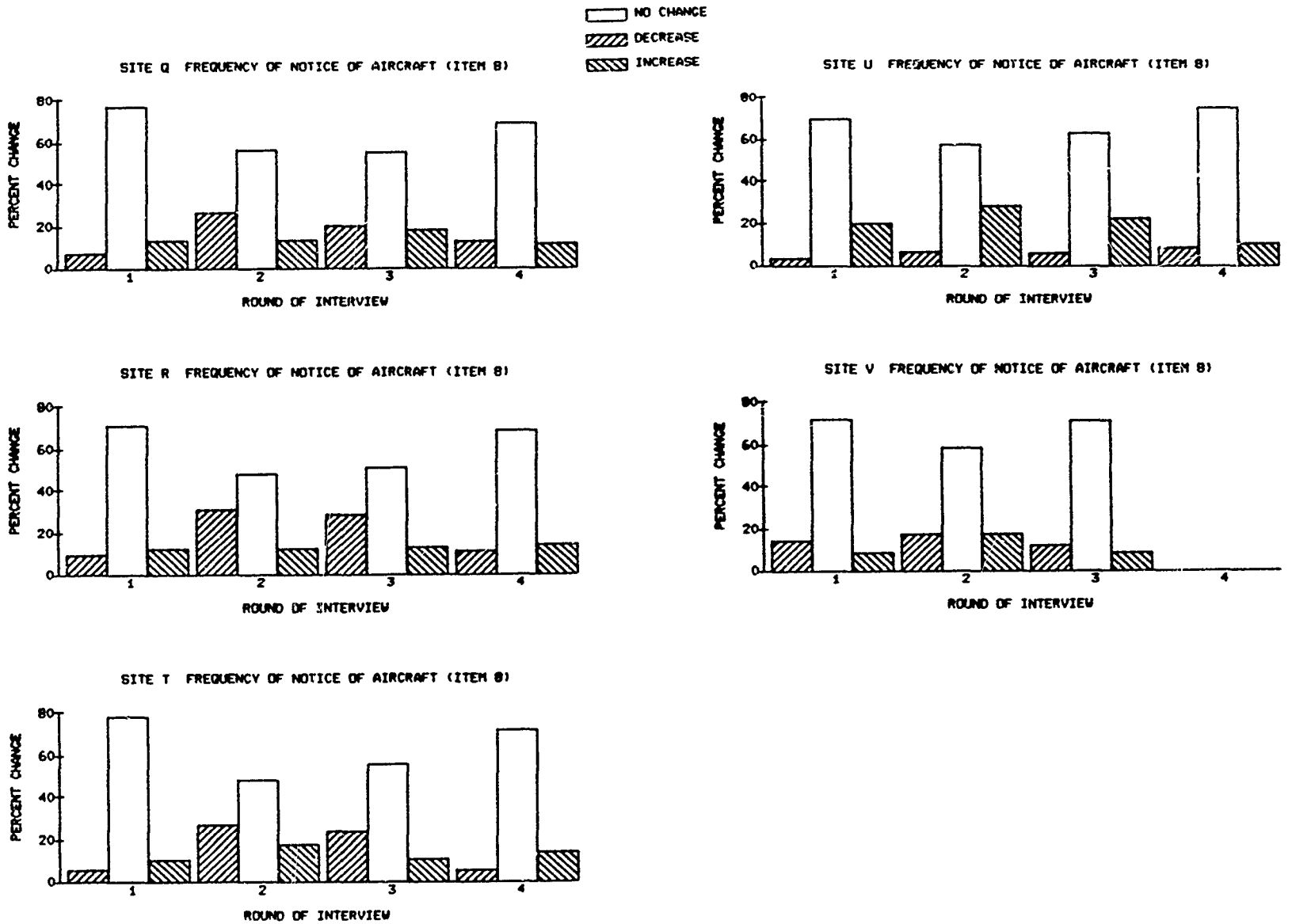


FIGURE 9. (CONTINUED)

TABLE 6. RESPONSE DISTRIBUTION FOR QUESTIONNAIRE ITEM 9.

SITE	NO	FEWER	MORE	DK NA REF
Glen Echo, Md. (C)				
Before	79.2	3.1	10.6	7.1
During	38.2	40.0	15.5	6.4
During	49.8	28.4	13.6	8.2
After	68.4	5.8	17.5	8.3
Cleveland Park, DC (E)				
Before	78.6	2.3	11.2	7.9
During	62.7	6.0	24.9	6.4
During	65.2	4.1	19.7	11.0
After	79.9	4.5	7.3	8.4
McLean, VA. (P)				
Before	75.0	5.1	14.0	6.0
During	40.9	7.1	48.8	3.2
During	46.4	5.5	39.7	9.4
After	71.6	10.5	12.2	5.7
Northwest Arlington, VA (H)				
Before	74.3	5.6	11.2	8.9
During	29.5	4.0	62.5	4.0
During	41.2	9.1	41.2	8.6
After	68.1	13.6	10.3	8.0
Kenilworth, DC (I)				
Before	73.1	10.8	9.6	6.4
During	66.8	12.5	16.8	3.9
During	68.9	9.2	14.7	7.1
Oxon Hill, MD (P)				
Before	71.4	8.8	14.3	5.5
During	54.7	14.8	21.5	8.9
During	57.7	12.5	23.7	7.1
After	68.8	15.9	8.3	7.2
Tantallon, MD (Q)				
Before	76.5	7.4	13.2	2.9
During	56.4	26.6	13.3	3.7
During	55.1	20.1	18.4	6.4
After	68.8	13.0	11.7	6.3
Fort Hunt, VA (R)				
Before	70.8	9.2	12.1	7.9
During	47.9	30.9	12.3	8.9
During	50.7	28.8	13.1	7.3
After	68.1	10.8	13.8	7.4
Langley, VA. (T)				
Before	78.0	5.5	10.1	6.0
During	48.0	26.6	17.3	8.1
During	55.8	23.9	10.8	9.6
After	71.3	5.8	13.7	9.0
Masonic Temple S. Alexandria, VA (U)				
Before	69.4	3.6	20.2	6.8
During	57.3	7.1	28.5	7.1
During	63.0	6.2	22.2	8.6
After	75.2	8.8	10.5	5.4
Benning Rd, DC/Seat Pleasant, MD (V)				
Before	71.8	14.5	8.6	5.0
During	59.0	17.5	17.9	5.7
During	71.6	12.3	8.5	7.6

NOTE: DK=DON'T KNOW; NA=NOT ASCERTAINED; REF=REFUSED

Responses for round 1 were quite consistent across sites. Between 70 and 80 percent of the population indicated no change, while the remainder of the respondents were fairly evenly divided between noticing more and fewer aircraft. These results suggest that respondents believed aircraft activity prior to round 1 was representative of the preceding year as a whole.

I. Responses to Item 9 (Window Position)

Figure 10 and Table 7 show the percentages of respondents reporting that the windows in their homes had been shut in the weeks prior to each round of interviews. A clear seasonal trend is apparent as the percentage of respondents reporting windows shut rose from approximately 60 percent in round 1 to 90 percent in all subsequent rounds.

J. Responses to Item 10 (Neighborhood Concerns)

Figure 11 shows the priority of concern (ranked by percentages of respondents very or extremely concerned) at each site with aircraft noise and safety for each round of interviews. Note that Site H (Northwest Arlington, VA), which exhibited the most dramatic change in prevalence of annoyance between rounds 1 and 4 and rounds 2 and 3, is the only site where a consistent and significant change between rounds is observed.

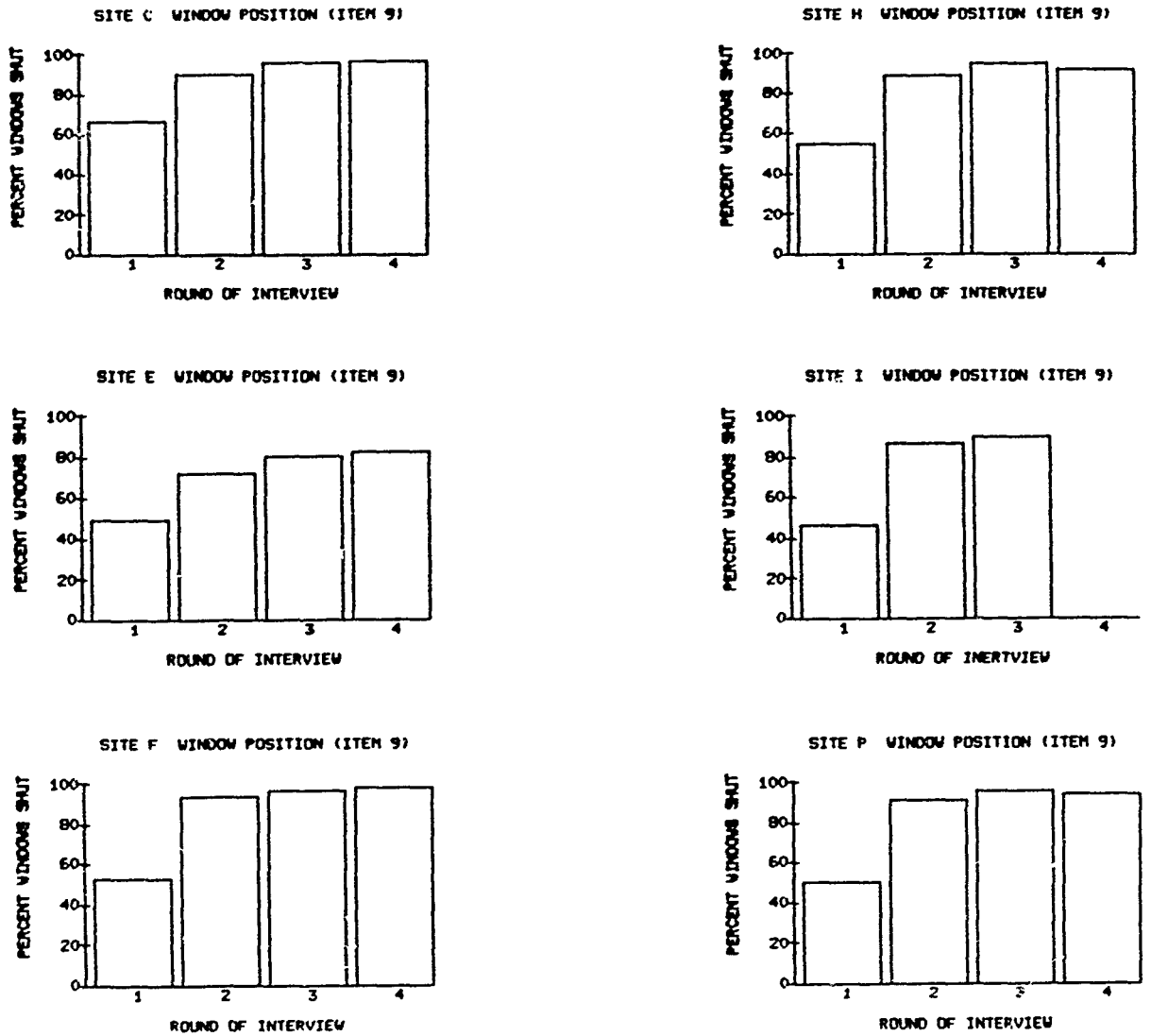


FIGURE 10. PERCENTAGES OF RESPONDENTS BY INTERVIEWING SITE AND ROUND REPORTING WINDOWS SHUT IN WEEK PRECEDING INTERVIEW

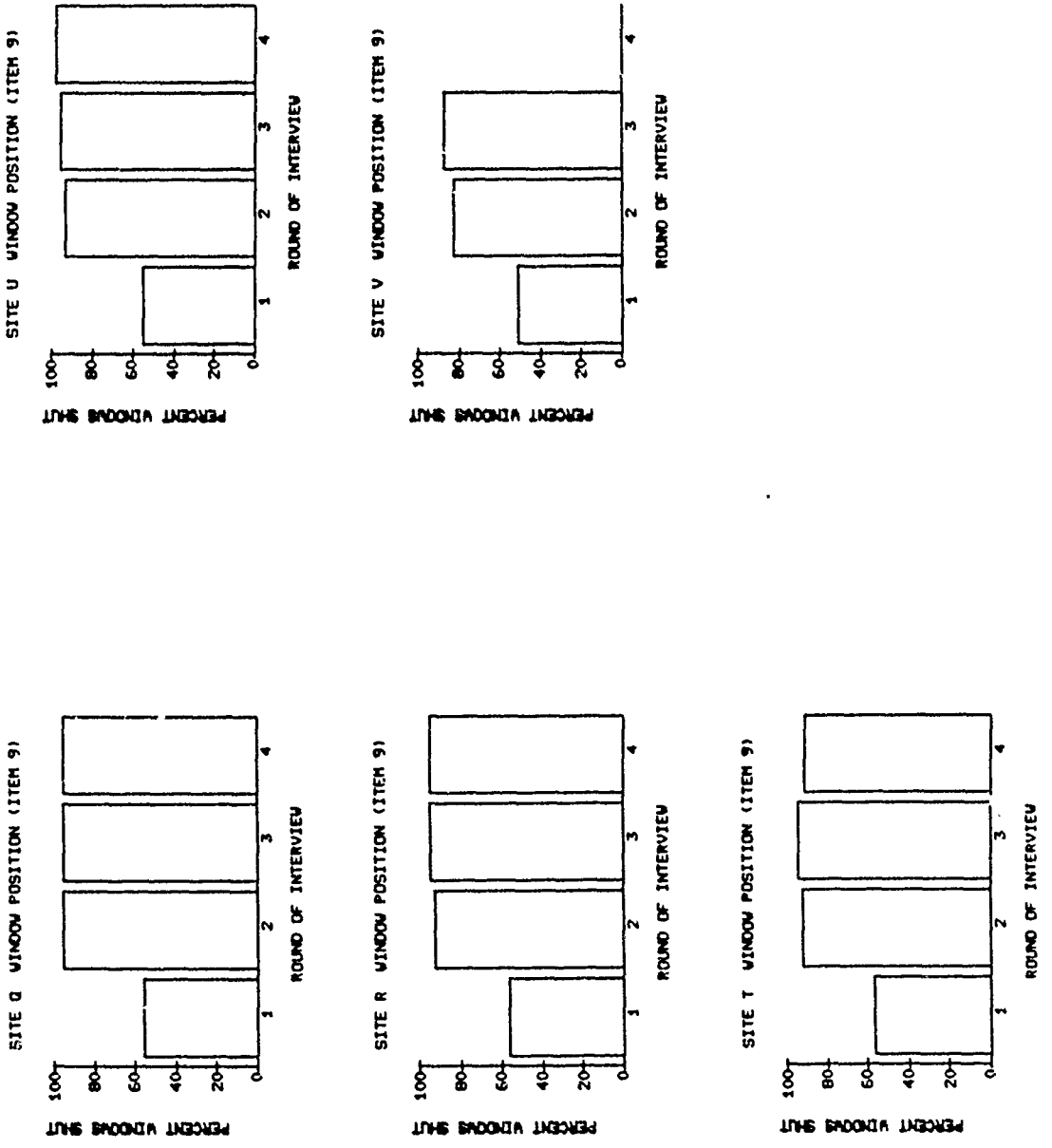


FIGURE 10. (CONTINUED)

TABLE 7. RESPONSE DISTRIBUTION FOR QUESTIONNAIRE ITEM 9.

SITE	OPEN	SHUT	DK NA REF
Glen Echo, MD (C)			
Before	28.3	66.4	5.3
During	5.5	90.0	4.5
During	2.5	96.3	1.2
After	1.9	97.1	1.0
Cleveland Park, DC (E)			
Before	43.7	49.8	6.5
During	22.1	72.4	5.5
During	14.3	81.1	4.6
After	13.4	83.2	3.4
McLean, VA (F)			
Before	43.6	52.1	4.3
During	3.1	94.1	2.8
During	1.3	96.6	2.1
After	1.3	98.3	0.4
Northwest Arlington, VA (H)			
Before	41.1	55.1	3.8
During	6.7	89.3	4.0
During	2.5	95.5	2.0
After	3.8	92.0	4.2
Kenilworth, DC (I)			
Before	48.6	47.0	4.4
During	10.5	86.7	2.8
During	8.0	90.3	1.7
Oxon Hill, MD (P)			
Before	45.6	50.7	3.7
During	5.8	91.9	2.3
During	3.1	96.4	0.5
After	4.3	94.7	1.0
Tantallon, MD (Q)			
Before	40.7	56.0	3.3
During	1.7	96.3	2.0
During	2.1	96.2	1.7
After	2.6	95.7	1.7
Fort Hunt, VA (R)			
Before	37.5	57.1	5.4
During	5.9	92.8	1.3
During	3.3	95.6	1.1
After	2.6	95.3	2.1
Langley, VA (T)			
Before	34.9	56.9	7.8
During	5.2	92.3	2.4
During	2.4	94.4	3.2
After	4.0	91.9	4.0
Masonic Temple S. Alexandria, VA (U)			
Before	39.5	55.6	4.8
During	3.9	93.6	2.5
During	0.8	95.9	3.3
After	0.8	98.3	0.8
Benning Road, DC/Seat Pleasant MD (V)			
Before	42.7	51.8	5.4
During	14.4	83.0	2.6
During	8.9	87.7	3.4

NOTE. DK=DON'T KNOW; NA=NOT ASCERTAINED; REF=REFUSED

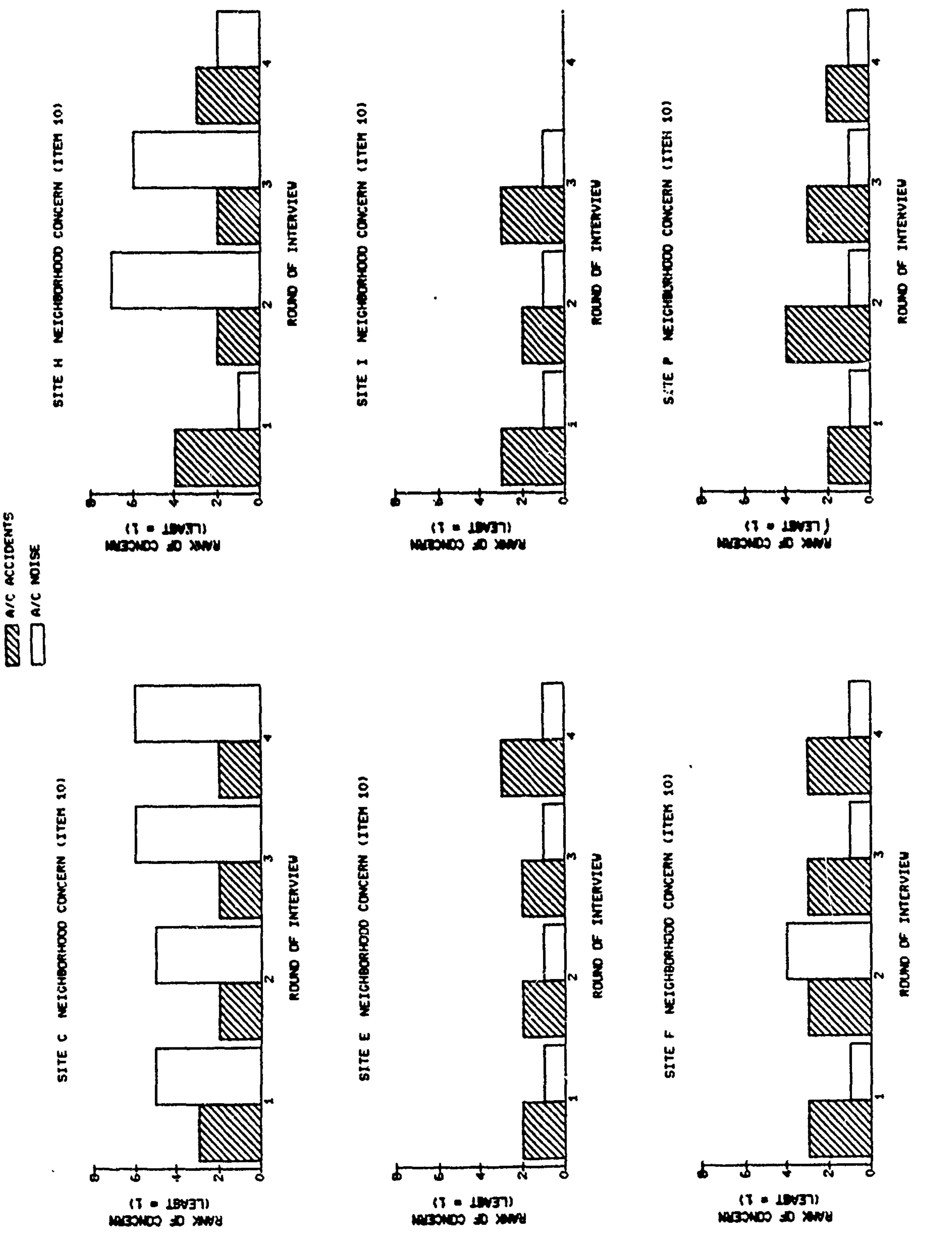


FIGURE 11. RANKING OF AIRCRAFT NOISE AND ACCIDENTS BY PREVALENCE OF CONCERN WITHIN INTERVIEWING SITES AND ROUNDS

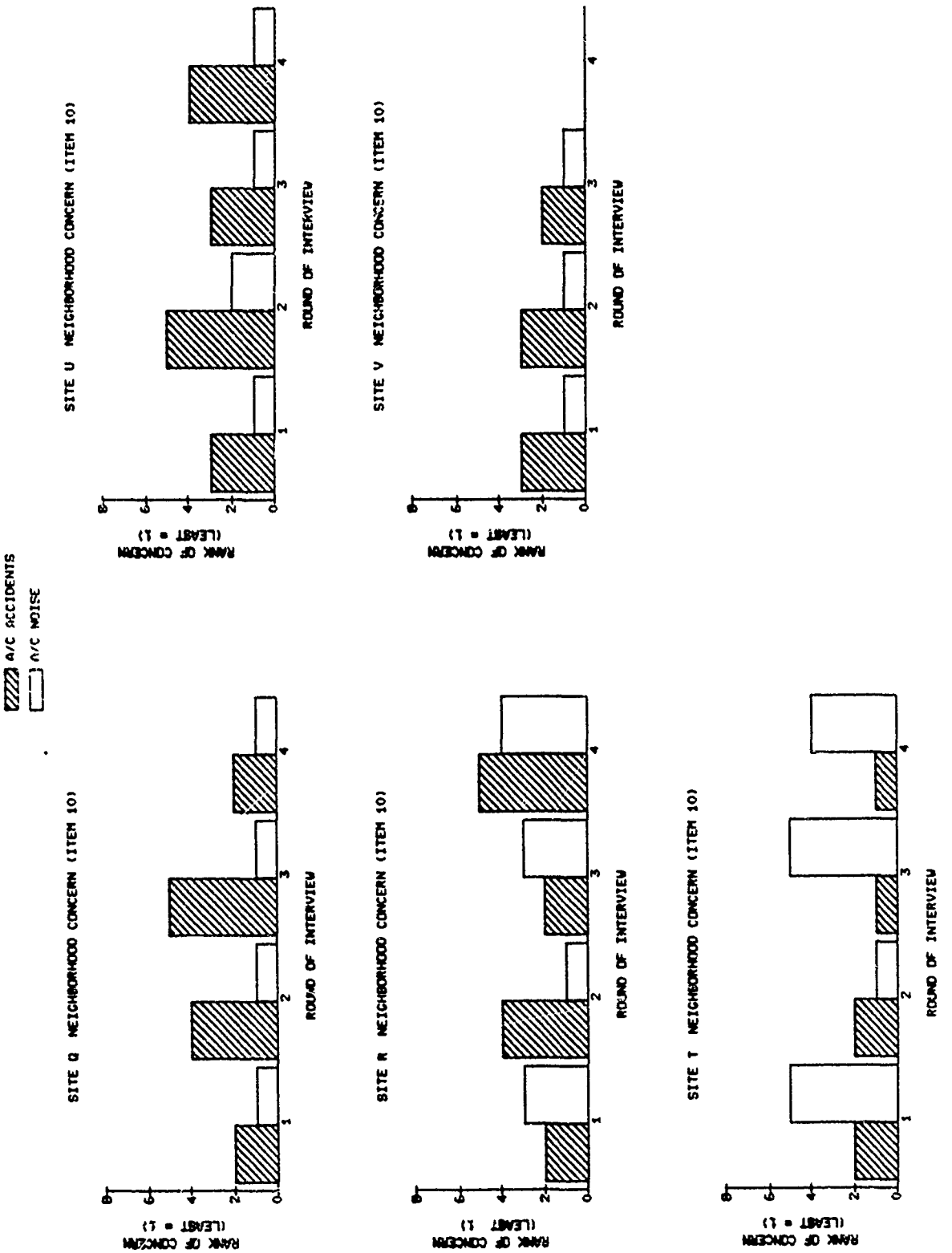


FIGURE 11. (CONTINUED)

K. Item 11 (Activity Interference)

Figure 12 shows the percentages of respondents at each site who reported that aircraft noise often interfered with communication or rest or relaxation in the weeks prior to each round of interviews. One of the more striking observations is the consistency of rank ordering of the three interference items across sites and rounds. Interference with radio and television listening is most frequently cited as "often", followed by conversation interference with rest and relaxation. Site H (Northwest Arlington,VA) exhibited the greatest change between round 1 and subsequent rounds. This trend is consistent with the responses from this site for items 5 and 6 (aircraft noise annoyance), item 8 (notice of greater number of aircraft), and item 10 (aircraft noise as neighborhood concern).

M. Summary of Cross-Tabulations

Cross-tabulations were prepared for three dichotomous variables (windows open or closed, sex of respondent, and duration of residence) for each round of interviews separately, and for the combined data of all rounds and sites. Ninety cross-tabulations were prepared for the three dichotomous variables against the following response variables: Neighborhood satisfaction, street traffic annoyance, neighborhood noisiness judgment, aircraft noise annoyance (week, month, and year), frequency of notice of

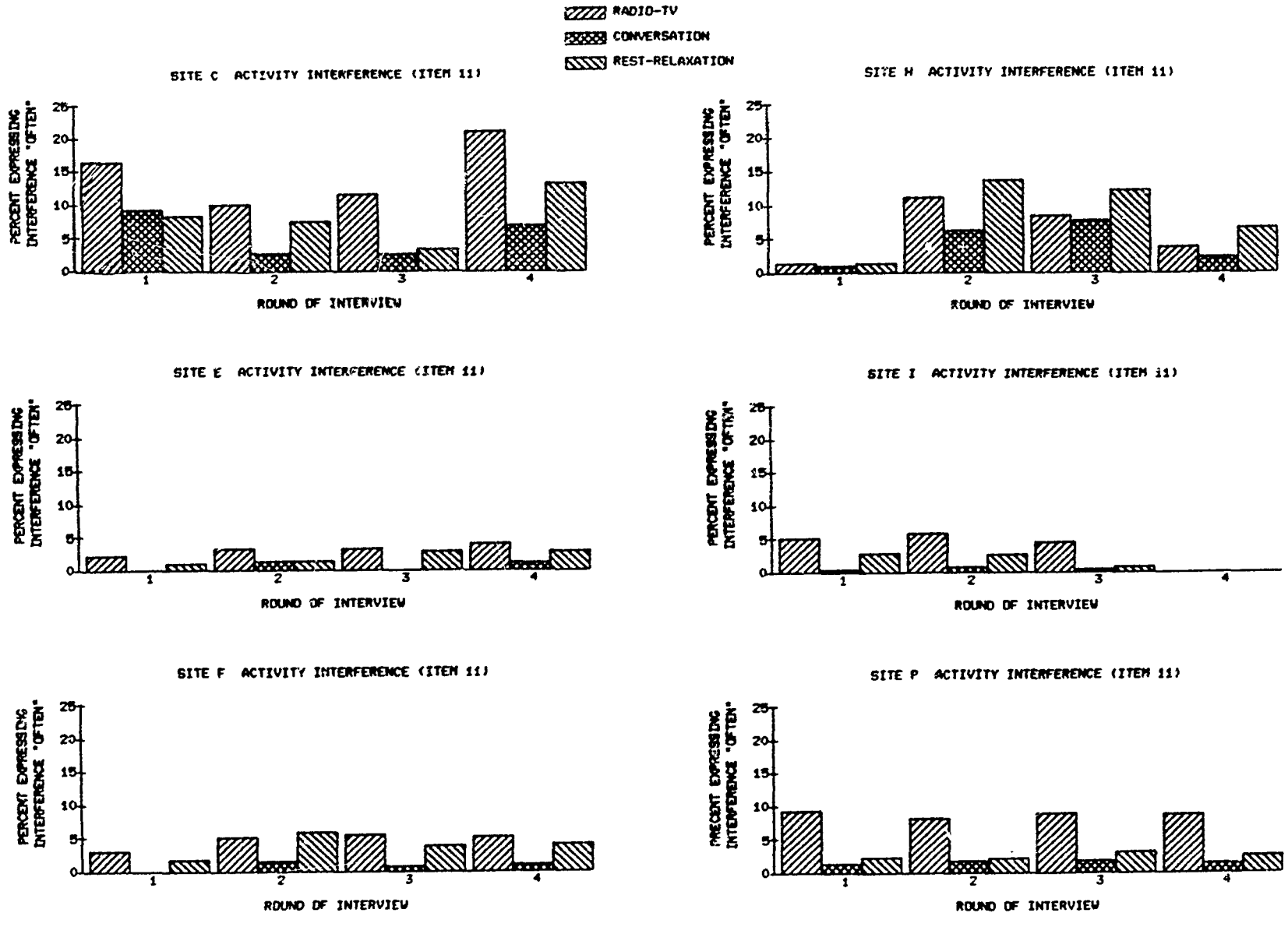


FIGURE 12. PERCENTAGES OF RESPONDENTS BY INTERVIEWING SITES AND ROUNDS REPORTING INDICATED INTERFERENCES DUE TO AIRCRAFT NOISE IN WEEK PRECEDING INTERVIEW

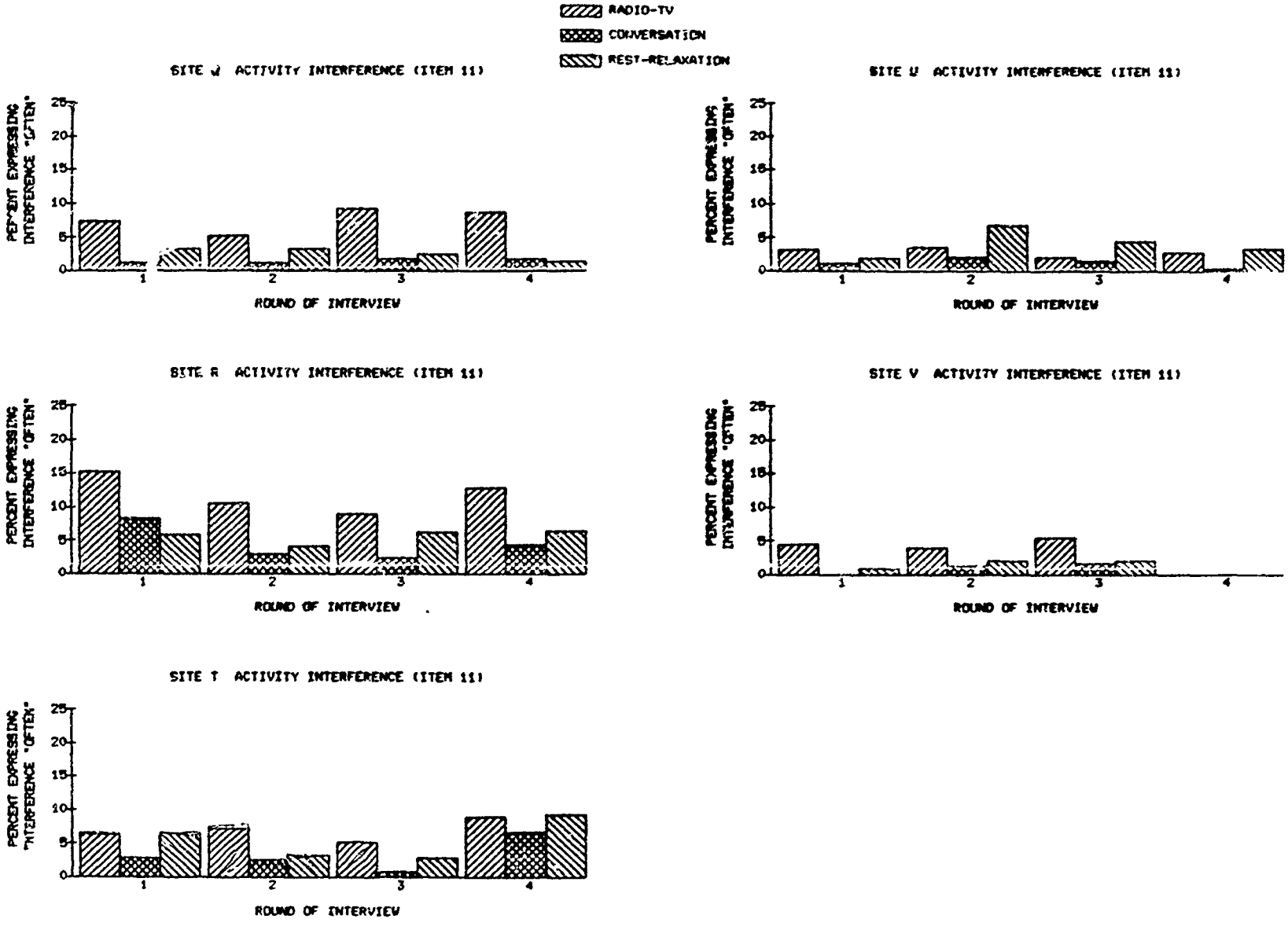


FIGURE 12. (CONTINUED)

aircraft, neighborhood concerns (air pollution, crime, unemployment, surface traffic accidents, aircraft accidents, taxes, heating bills, and aircraft noise), communication interference, and disturbance of rest and relaxation.

Many of the cross-tabulations contained splits so extreme (e.g., 95% or more of the respondents in one category, 5% or fewer in the alternative category) that percentages of potential interest are based on very small numbers of respondents. Percentages based on such small samples tend to be unstable and unreliable, and thus do not merit detailed interpretation. Among those cross-tabulations with less extreme splits, the observed response distributions for substantive questionnaire items were likely to have arisen by chance alone (i.e., were statistically insignificant).

Although the cross-tabulations shed little light on aircraft noise exposure-related issues, several of them are of interest for procedural reasons. For example, Figure 13 shows that the prevalence of high annoyance does not differ meaningfully for men and women. Figures 14 and 15 show that slightly greater percentages of women than men were concerned by aircraft noise and safety. However, it should be noted that slightly larger percentages of women than men were concerned about <u>all</u> neighborhood issues (cf. Figure 16).

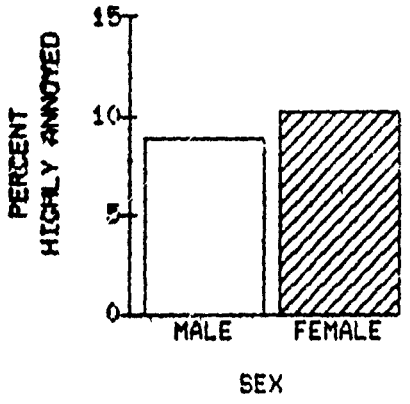


FIGURE 13. CROSS-TABULATION OF ANNOYANCE DUE TO AIRCRAFT NOISE (PAST WEEK) BY SEX (ITEM 5) ALL SITES - ALL ROUNDS

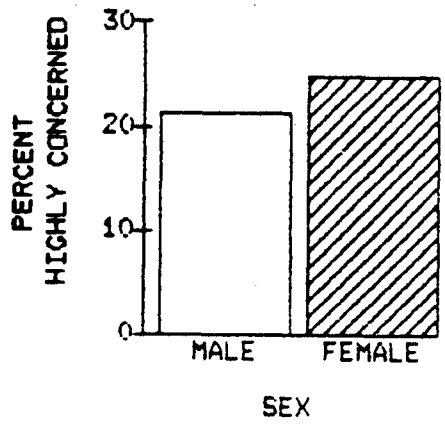


FIGURE 14. CROSS-TABULATION OF PREVALENCE OF CONCERN WITH AIRCRAFT NOISE BY SEX (ITEM 10) ALL SITES - ALL ROUNDS

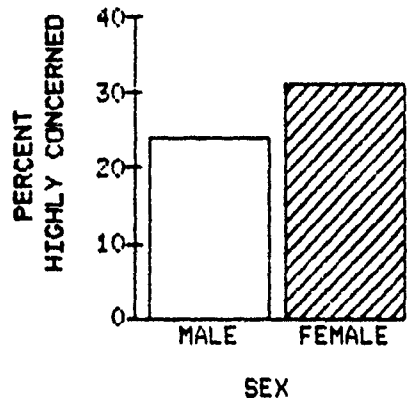


FIGURE 15. CROSS-TABULATION OF PREVALENCE OF CONCERN WITH AIRCRAFT ACCIDENTS BY SEX (ITEM 10) ALL SITES - ALL ROUNDS

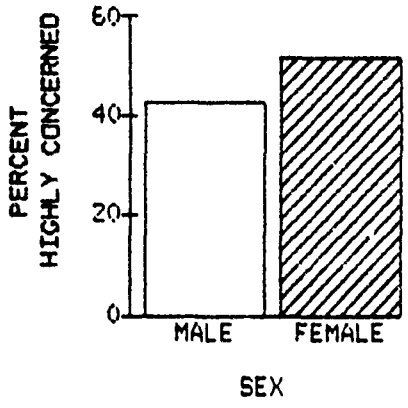


FIGURE 16. CROSS-TABULATION OF PREVALENCE OF CONCERN WITH HEATING BILLS BY SEX (ITEM 8) ALL SITES - ALL ROUNDS

REFERENCES

Schultz, T., "Community Noise Rating", Applied Science Publishers, (1982).

Schultz, T., "Synthesis of social surveys on noise annoyance, J. Acoust. Soc. Am., 64(1978), pp. 377-405.

APPENDIX A

BRIEFING ON PROPOSED EXPERIMENTAL DESIGN AND ANALYSIS OF COMMUNITY REACTION TO DEPARTURE SCATTER PLAN AT WASHINGTON NATIONAL AIRPORT

28 SEPTEMBER 1983

PURPOSE OF SURVEY

The Metropolitan Washington Council of Governments is responsible for conducting an attitudinal survey to document changed attitudes toward noise related to the test of the scatter plan. To help MWCOG perform this evaluation, a social survey is desired to collect information on community response to the anticipated changes in aircraft noise exposure. In keeping with standard practice, federal policy and the best available scientific information, the effect of aircraft noise on people of greatest present interest is annoyance.

GOAL OF SURVEY

The natural concern in an evaluation of the present sort is the greatest good for the greatest number of people. Information is therefore needed to support quantitative comparisons of the changes in numbers of people who are annoyed in some consequential degree by changes in aircraft noise exposure.

Fractional Impact Analysis is the preferred technique for making these comparisons. This method was adopted by EPA'S Office of Noise Abatement and Control to calculate an index

known as the Noise Impact Index (NII). To be most useful, this index should be based on knowledge of the local relationship between aircraft noise exposure and the prevalence of annoyance. Thus, the fundamental goal of the social survey is to document changes in annoyance associated with changes in Day/Night Average Sound levels due to aircraft noise.

SAMPLING

A. Size

The number of people who must be interviewed at each site depends on the expected size of change in noise exposure. Small changes in noise exposure which can be expected to change the prevalence of annoyance at a site only slightly, require large sample sizes. Large changes in noise exposure, which can be expected to change the prevalence of annoyance more greatly, can be documented with smaller sample sizes.

In statistical terms, sample size must be adequate to reject the hypothesis that any changes in prevalence of annoyance observed between rounds of interviews are due to chance alone. For samples of 200 people or larger, this hypothesis

can be confidently rejected if the change in Day/Night Average Sound Level is greater than about 3 decibels.

B. Sampling Frame

A sampling frame is a list of all respondents eligible for interview. It should obviously be as current and exhaustive as possible. For present purposes, the street address telephone directory is the preferred sampling frame.

C. Sampling Unit

Since it is the effect of aircraft noise on residential population that is of current concern, the residential household should be the sampling unit. Only one interview per household will be permitted (from an adult, English speaking household resident), because interviews with more than one household resident would be likely to yield correlated (non-independent) information.

SITE SELECTION

The overriding concerns in site selection are magnitude and direction of expected change in aircraft noise exposure. All other things being equal, the most desirable sites for

interviewing are those at which the greatest increases and decreases in aircraft noise exposure are expected. Available resources can be used most efficiently for sampling and interviewing at such sites.

Because MWCOG requires information about both the advantages and the disadvantages of the scatter plan, interviews must be conducted not only at sites where aircraft noise exposure is expected to decrease, but also at sites where aircraft noise exposure is expected to increase. The numbers of sites of increasing and decreasing exposure should be proportional to the sizes of the populations exposed to increasing and decreasing levels of aircraft noise exposure.

Secondary site selection criteria include jurisdictional boundaries and the feasibility of telephone interviewing. To the extent practicable, site boundaries should not cross political boundaries, nor should telephone interviewing be attempted in neighborhoods with large number of non-English speaking, highly transient, or unlisted households. Likewise, it is not cost-effective to interview in sparsely populated areas.

Proximity to one of FAA's noise measurement points, although desirable, is not necessarily a major criterion for survey

site selection. This is because the field measurements are intended only to verify calculated noise impacts, and not to document changes in actual aircraft noise exposure within specifiable geographic areas.

TIMING OF INTERVIEWS

A. When to Interview

The first round of interviews is scheduled for the weekend prior to the institution of the scatter plan. The timing of the second round of interviews depends on several factors, not the least of which is the duration of the actual test of the scatter plan. Another factor is the time period in which FAA intends to monitor noise levels. Perhaps the most important factor is the growth of annoyance with duration of noise exposure.

It is documented that the prevalence of annoyance changes with exposure duration. People do not become annoyed instantaneously by noise exposure, nor do they immediately forget their reactions to noise exposure the instant it ends. In fact, there is reason to believe that weeks to months must pass before a stable pattern of opinions emerges following a change in aircraft noise exposure.

For this reason, it is preferable that the second round of interviews be conducted approximately eight weeks after the institution of the scatter plan, but for practical reasons a shorter test period may be required. Therefore, the second round of interviews will be tentatively scheduled at 30 days into the test.

The intent of the third round of interviews is to verify that the prevalence of annoyance in neighborhoods has reverted to the pattern existing before the institution of the scatter plan; therefore, interviews should be conducted approximately two months after the end of the scatter plan test. Secondary purposes of the third round of interviews could be to explore seasonal effects on annoyance, or to confirm that the prevalence of annoyance has stabilized. To serve these latter purposes, some interviews could be conducted immediately prior to the end of the scatter plan test. Since this decision is not crucial at this point in the study design this decision may be postponed to a later date.

A further complication is the direction of flow of airport traffic. The predominant direction of flow in the coming months is to the north. If, in fact, there are few or no operations to the south in the week prior to a scheduled

round of interviews, there may be little to learn about the annoyance of people at sites south of the airport. Under such conditions, it is prudent to consider the possibility of conducting interviews at the northern and southern sites at different times.

B. Duration of Interviewing

Each round of interviews should be completed as rapidly as possible, preferably within a weekend. There are two bases for this recommendation. First, as discussed above, annoyance changes with exposure duration. To avoid a blurred "snapshot" of the pattern of annoyance at interviewing sites, opinions at all sites must be surveyed in a short period of time.

Second, due to the highly politicized nature of the scatter plan test, it is likely that influences other than noise exposure may affect opinions. Interviewing in a brief span of time helps to minimize the effects of publicity and organized efforts on genuine attitudes of noise-induced annoyance.

QUESTIONNAIRE

The design of the questionnaire must be tailored to the goals and operational constraints of interviewing. The goal of the survey, as noted earlier, is a limited and specific one: to document changes in the prevalence of noise-induced annoyance, to provide information for a Fractional Impact Analysis. The operational constraints include the requirement for collection of information from a large number of people (nominally, 200 at each of 14 sites, or 2800 people) in about 20 interviewing hours.

Thus, each questionnaire item must be directly related to the goal of the survey; there is no time or reason to collect non-essential information, or information that cannot be interpreted in the context of the Fractional Impact Analysis. Likewise, all questions should be of the closed response category variety, rather than open-ended.

The interview should be solicited with an introduction that identifies MWCOG as its sponsor, and states only that it is a study of environmental conditions in the neighborhood. The lead-in question should be a non-controversial confirmation that the potential respondent is indeed a resident of the selected household. The first substantive matter

addressed should be neighborhood satisfaction. Responses to one or two such items may be sensitive to changes in aircraft noise exposure, while providing a context for understanding reactions to aircraft noise.

The next issue addressed by the questionnaire should be annoyance due to local street traffic noise, which is not expected to change throughout the scatter plan test. The key questions about annoyance due to aircraft noise exposure should follow immediately. The final questionnaire items can address subsidiary issues if necessary, such as concerns with aircraft safety and interference with verbal communication.

Since there is no opportunity to pilot test questionnaire items, it is strongly recommended that the wording of the present interview resemble as closely as possible that of prior aircraft noise interviews. This will aid interpretation of responses of Washington area residents in terms of responses documented elsewhere. A five category scale of annoyance, utilizing the terms "Not at all Annoyed, Slightly Annoyed, Moderately Annoyed, Very Annoyed, Extremely Annoyed", would be used for all items assessing degree of annoyance.

ANALYSIS

In each round of interviews, raw data would be tabulated by site for each questionnaire item. Graphs would then be prepared to permit visual comparisons of any changes in percentages of the sample responding in various categories. An indication would also be provided of the extent of change that could be attributed to chance alone.

The percentages of respondents describing themselves as "very" or "extremely" annoyed by aircraft noise would be summed to form the "highly annoyed" metric used in Fractional Impact Analysis. This information is the dependent variable plotted on the ordinate of a dosage-effect relationship. FAA would be expected to supply estimates of aircraft (not total community) noise exposure to plot on the abscissa of the dosage-effect relationship.

PURPOSE OF SURVEY

QUANTIFY COMMUNITY RESPONSE TO CHANGES IN AIRCRAFT NOISE EXPOSURE

RECOMMENDED MEASURE OF COMMUNITY RESPONSE:

PROPORTION OF POPULATION ANNOYED IN SOME CONSEQUENTIAL DEGREE BY AIRCRAFT NOISE

RECOMMENDED MEASURE OF AIRCRAFT NOISE:

DAY/NIGHT AVERAGE SOUND LEVEL (L_{dn})

BASIC GOAL OF SURVEY

COLLECT INFORMATION NECESSARY TO SUPPORT A SYSTEMATIC ANALYSIS OF CHANGES IN THE PREVALENCE OF ANNOYANCE ASSOCIATED WITH CHANGES IN AIRCRAFT NOISE EXPOSURE

WHEN TO INTERVIEW

1. PREVALENCE OF LONG TERM ANNOYANCE CHANGES SLOWLY OVER TIME

2. INTERVIEWING BEFORE ATTITUDE CHANGE STABILIZES CAN MIS-ESTIMATE PREVALENCE OF ANNOYANCE

3. CONSTRUCTION OF DOSAGE-EFFECT RELATIONSHIPS REQUIRES TEMPORAL LINK BETWEEN MEASUREMENTS OF NOISE AND ATTITUDE

4. WIND DIRECTION MAY MINIMIZE EXPOSURE CHANGES SOUTH OF AIRPORT

RELATIONSHIP OF SAMPLE SIZE TO EXPOSURE CHANGES

1. CHANGE IN PROPORTION OF POPULATION HIGHLY ANNOYED PER DECIBEL OF NOISE EXPOSURE

2. SMALL EXPOSURE CHANGES REQUIRE LARGE SAMPLES

3. MOST EFFICIENT USE OF RESOURCES REQUIRES INTERVIEWING AT SITES WITH LARGEST CHANGES IN EXPOSURE

SITE SELECTION CRITERIA

1. MAGNITUDE OF EXPECTED CHANGE IN AIRCRAFT NOISE EXPOSURE
2. DIRECTION OF EXPECTED CHANGE IN EXPOSURE
3. HOMOGENEITY OF EXPOSURE
4. SUITABILITY FOR TELEPHONE INTERVIEWING
5. GEOGRAPHIC LOCATION

DURATION OF INTERVIEWING

1. PEOPLE'S OPINIONS CHANGE AS THEIR NOISE EXPOSURE CHANGES

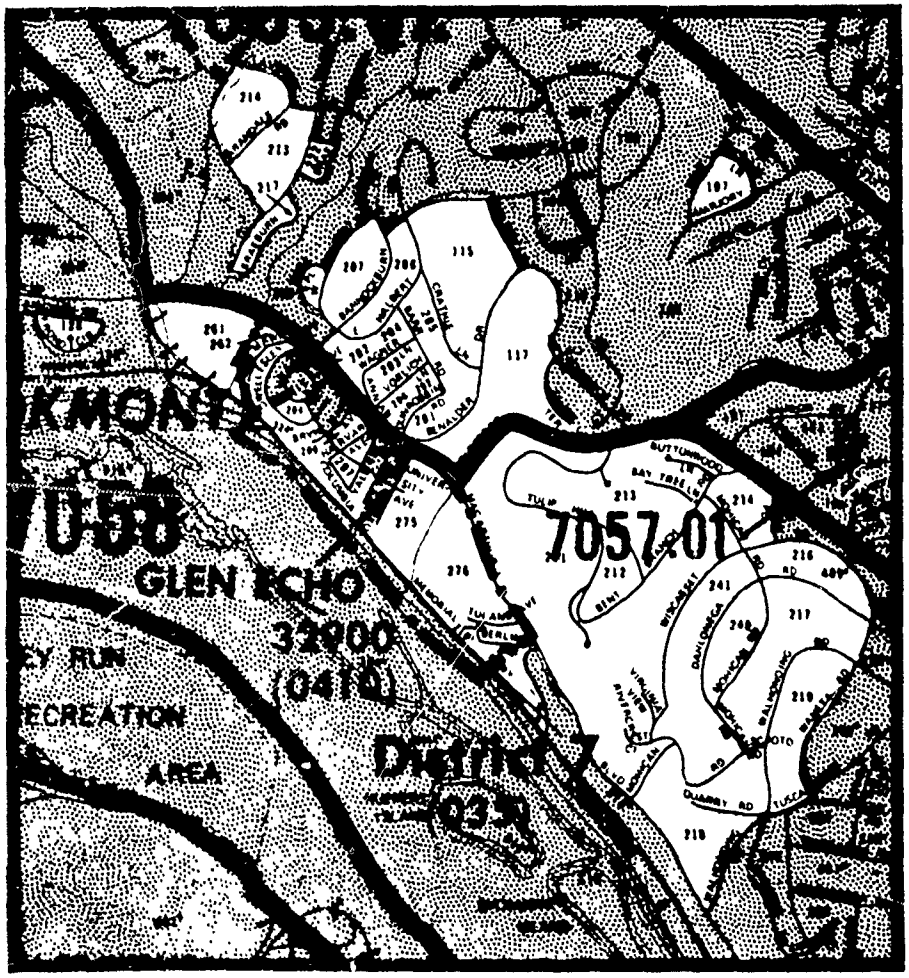
2. PEOPLE'S OPINIONS CHANGE OVER TIME FOR REASONS UNRELATED TO NOISE EXPOSURE AS WELL

3. INFORMATION COLLECTED WITHIN A SHORT PERIOD OF TIME IS MOST READILY INTERPRETED

APPENDIX B

CENSUS TRACTS AND BLOCKS FOR INTERVIEWING SITES

TRACT MAP: 52 SITE C



SITE C

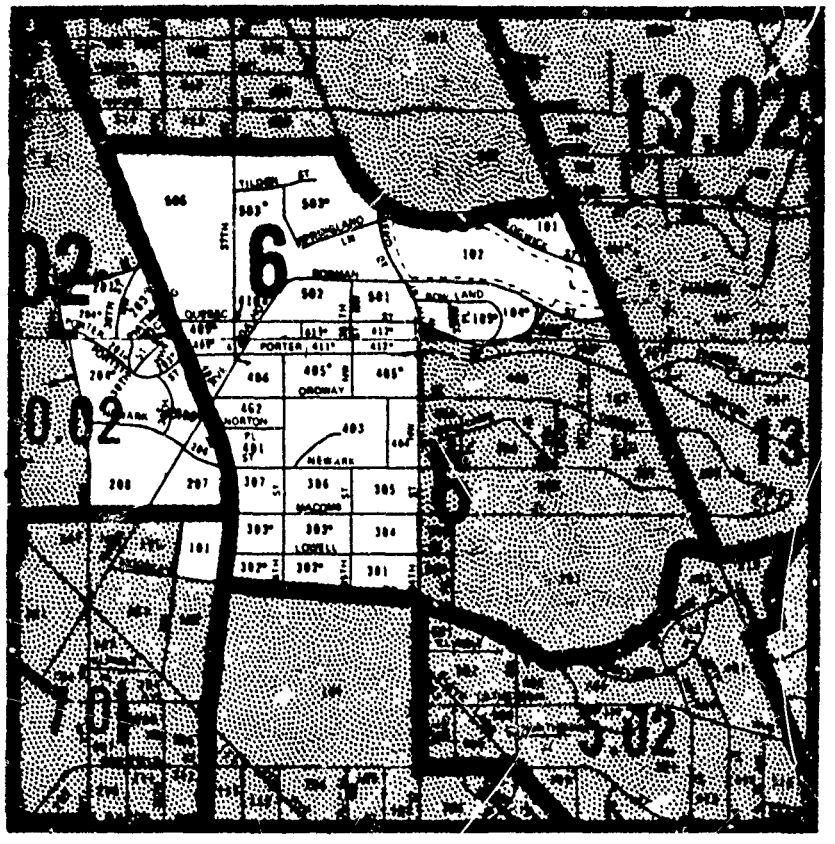
Glen Echo, MD

CENSUS TRACT: 7057.01
BLOCKS: 211, 212, 213, 214, 216, 217, 218, 219, 240, 241

CENSUS TRACT: 7058
BLOCKS: 128, 204, 206, 207, 261, 262, 275, 276

CENSUS TRACT: 7059.02
BLOCKS: 107, 115, 117, 201, 202, 203, 204, 205, 206, 208, 213, 214, 217, 222

TRACT MAPS: 53, 60 SITE E



SITE E

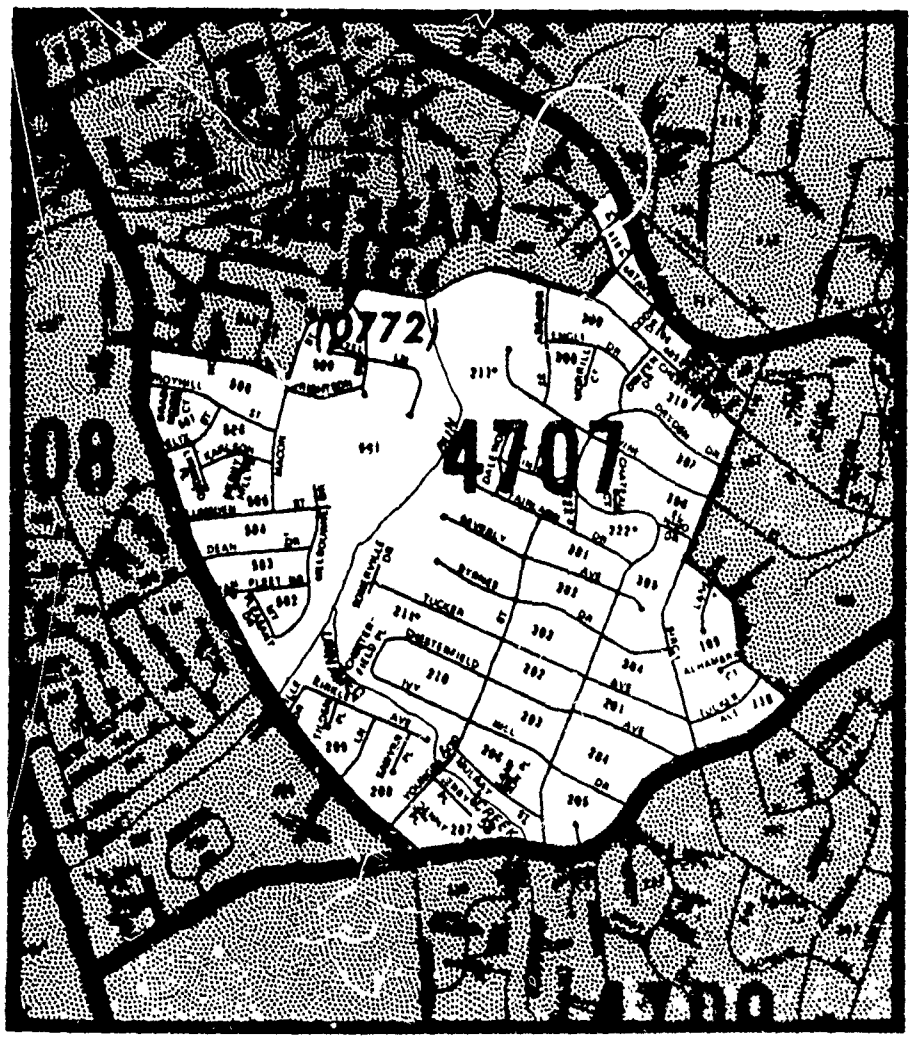
Cleveland Park, DC

CENSUS TRACT: 0006
BLOCKS: 101, 102, 104, 105, 302, 303, 304, 305, 306, 307, 401, 402, 403, 404, 405, 406, 408, 409, 410, 411, 412, 501, 502, 503, 506

CENSUS TRACT: 0007.01
BLOCK: 101

CENSUS TRACT: 10.02
BLOCKS: 201, 203, 204, 205, 206, 207, 208

TRACT MAP: 60 SITE F

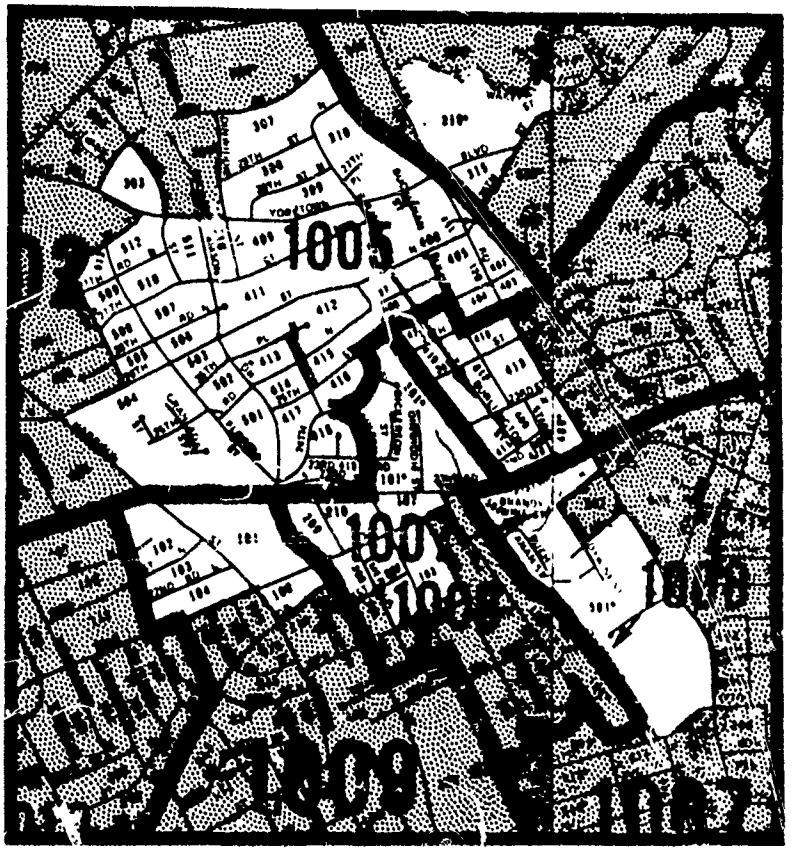


SITE F

McLean, VA

CENSUS TRACT: 4707
BLOCKS: 109, 110, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 301, 302, 303, 304, 305, 306, 307, 308, 309, 310, 405, 406, 407, 410, 501, 502, 503, 504, 505, 506, 507, 508, 509

TRACT MAP: 61 SITE H



SITE H

Northwest Arlington, VA

CENSUS TRACT: 1002
BLOCKS: 303, 307, 308, 309, 310, 401, 402, 403, 404, 405, 406, 407, 408, 409, 410, 411, 412, 413, 414, 415, 416, 417, 418, 419, 501, 502, 503, 504, 505, 506, 507, 508, 510, 511, 512

CENSUS TRACT: 1003
BLOCKS: 313, 315

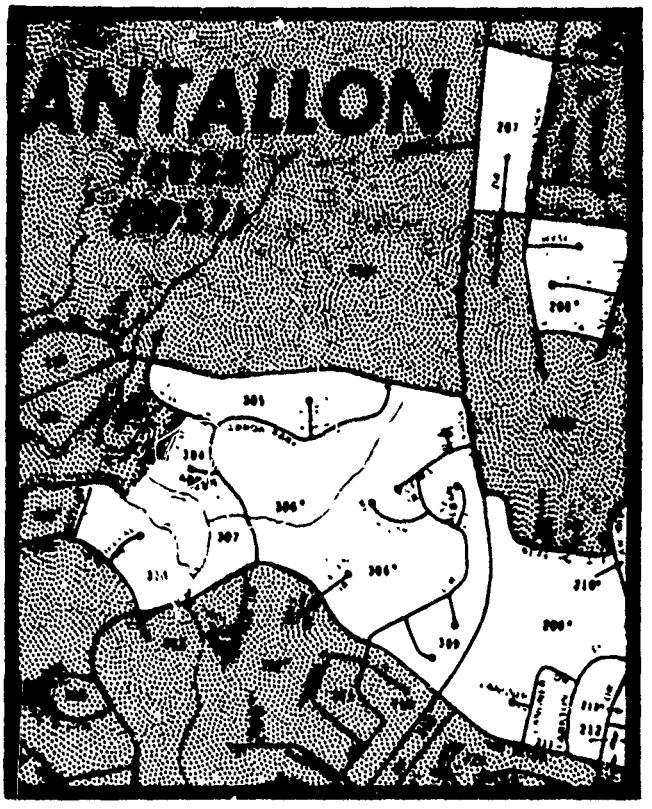
CENSUS TRACT: 1005
BLOCKS 409, 410, 411, 412, 413, 418, 419, 420

CENSUS TRACT: 1007
BLOCK: 501

CENSUS TRACT: 1008
BLOCKS: 101, 102, 103, 206, 207, 208, 209, 210

CENSUS TRACT: 1009
BLOCKS: 101, 102, 103, 104, 108

TRACT MAP: 89 SITE Q

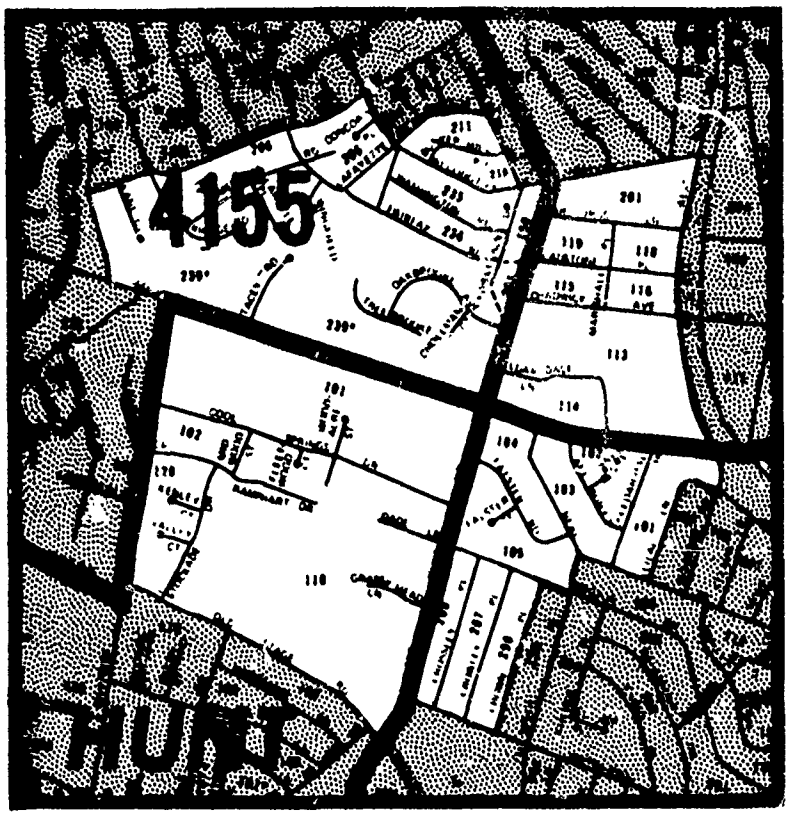


SITE Q

Tantallon, MD

CENSUS TRACT: 8013.03
BLOCKS: 207, 208, 209, 210, 211, 212, 213, 214, 304, 305, 306, 307, 309, 314

TRACT MAP: 89 SITE R



SITE R

Ft. Hunt, VA

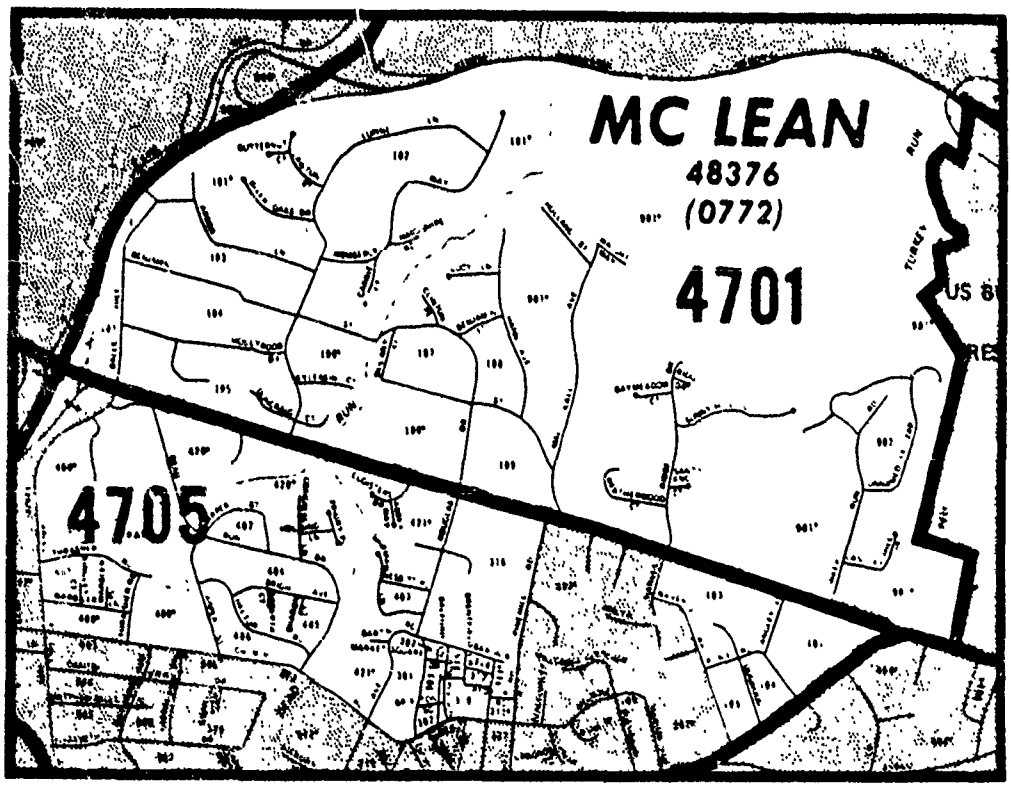
CENSUS TRACT: 4156
BLOCKS: 113, 114, 115, 116, 118, 119, 201

CENSUS TRACT: 4158
BLOCKS: 101, 102, 118, 120

CENSUS TRACT: 4155
BLOCKS: 205, 206, 210, 211, 235, 236, 239, 250, 251

CENSUS TRACT: 4157
BLOCKS: 101, 102, 103, 104, 105, 205, 206, 207, 208

TRACT MAP: 52 SITE T



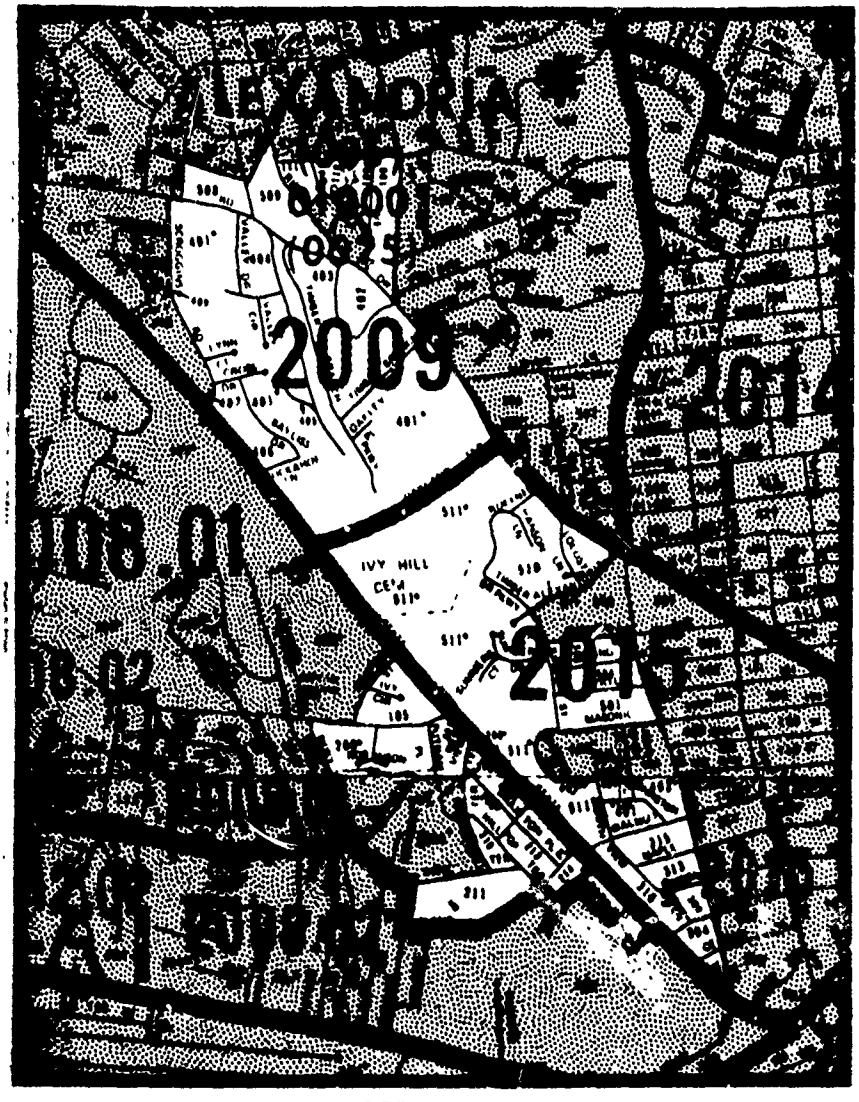
SITE T

Langley, VA

CENSUS TRACT: 4701
BLOCKS: 101, 102, 103, 104, 105, 106, 107, 108, 109, 901, 902

CENSUS TRACT: 4705
BLOCKS: 101, 103, 104, 105, 301, 302, 303, 310, 311, 312, 314, 315, 316, 402, 403, 404, 405, 406, 407, 408, 420, 421

TRACT MAP: 71, 78 SITE U



SITE U

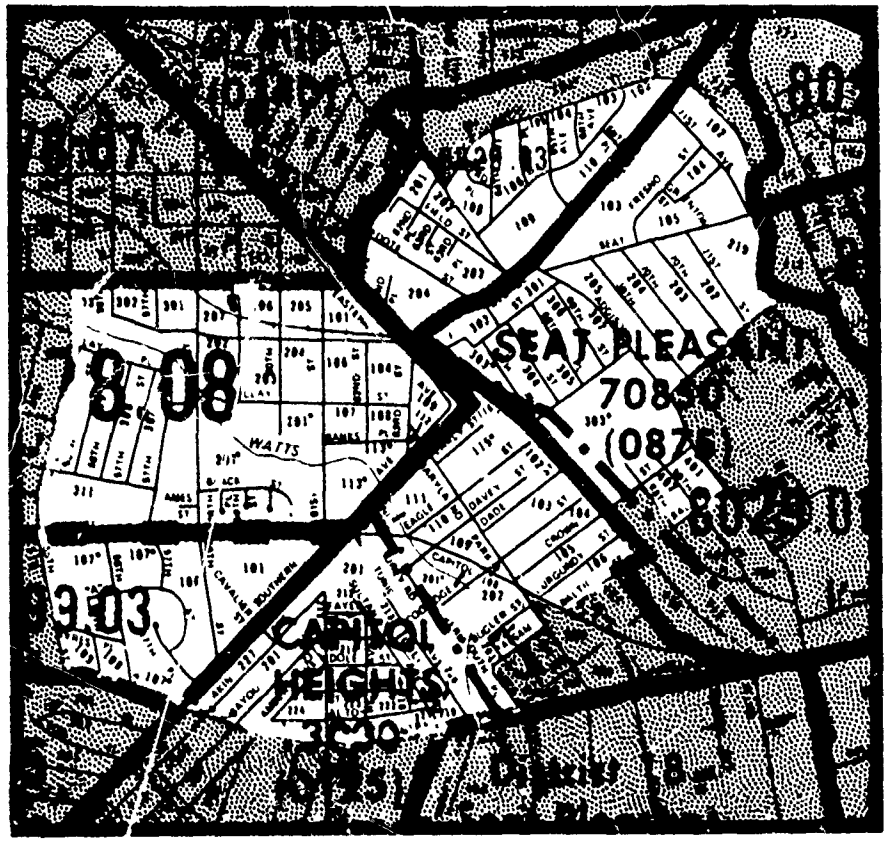
Masonic Temple/S. Alexandria, VA

CENSUS TRACT: 2009
BLOCKS: 108, 109, 110, 111, 401, 402, 403, 404, 405, 406, 508, 509

CENSUS TRACT: 2008.01
BLOCKS: 105, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215

CENSUS TRACT: 2015
BLOCKS: 303, 304, 309, 313, 315, 316, 401, 402, 403, 501, 504, 505, 510, 511

TRACT MAP: 59 SITE V



SITE V

Benning Road, DC/Seat Pleasant, MD

CENSUS TRACT: 8029.03
BLOCKS: 102, 103, 104, 105, 106, 107, 108, 109, 110, 201, 202, 203, 204

CENSUS TRACT: 8029.01
BLOCKS: 102, 103, 104, 105, 202, 203, 204, 205, 219, 301, 302, 303, 304, 305, 306, 307, 401, 402

CENSUS TRACT: 8027
BLOCKS: 102, 103, 104, 105, 106, 108, 109, 110, 111, 115, 116, 201, 202, 203, 211, 212, 213, 214, 217, 218, 219, 220, 221, 222, 223, 224, 225, 227

CENSUS TRACT: 0099.03
BLOCKS: 101, 106, 107, 108, 109

CENSUS TRACT: 0078.08
BLOCKS: 101, 104, 106 107, 108, 109, 112, 113, 201, 202, 203, 204, 205, 206, 207, 301, 302, 303, 307, 308, 309, 310, 311

APPENDIX C

QUESTIONNAIRE

SITE: _____

INTRODUCTION: "This is (interviewer name) calling for the Washington Council of Governments. We're conducting a study of environmental conditions in the Washington area, and would appreciate a few moments of your time to answer some brief questions."

ITEM	QUESTION	RESPONSE	CODE	CC
1	How long have you lived on (street name)? Verbatim: _____	Number of months .... Don't know ..... 777 Not Ascertained ..... 888 Refused 999		(25-27)
2	How would you rate your neighborhood as a place to live? Would you say it's a very poor place to live, a poor, fair, good, or an excellent place to live?	Very Poor ..... 0 Poor ..... 1 Fair ..... 2 Good ..... 3 Excellent ..... 4 Don't Know ..... 7 Not Ascertained ..... 8 Refused 9		(28)
3	While you've been at home during this past week, just since last (Fri/Sat/Sun), have you been bothered or annoyed by street traffic noise? If Yes, ASK: Would you say you've been slightly annoyed by street traffic noise, moderately annoyed, very annoyed or extremely annoyed by street traffic noise?	No (Not at all Annoyed). 0 Slightly Annoyed ..... 1 Moderately Annoyed ..... 2 Very Annoyed ..... 3 Extremely Annoyed ..... 4 Don't Know ..... 7 Not Ascertained ..... 8 Refused 9		(29)
4	Would you say that over the past year, your neighborhood has been quiet or noisy? IF QUIET, ASK: Would you say it's been slightly quiet, moderately quiet, very quiet or extremely quiet? IF NOISY, ASK: Would you say it's been slightly noisy, moderately noisy, very noisy or extremely noisy?	Slightly Quiet ..... 10 Moderately Quiet ..... 20 Very Quiet ..... 30 Extremely Quiet ..... 40 Slightly Noisy ..... 01 Moderately Noisy ..... 02 Very Noisy ..... 03 Extremely Noisy ..... 04 Don't Know ..... 77 Not Ascertained ..... 88 Refused 99		(30,31)
5	While you've been at home this past week, have you been bothered or annoyed by aircraft noise? IF YES, ASK: Would you say you've been slightly annoyed by aircraft noise, moderately annoyed, very annoyed or extremely annoyed by aircraft noise?	No (Not at all Annoyed). 0 Slightly Annoyed ..... 1 Moderately Annoyed ..... 2 Very Annoyed ..... 3 Extremely Annoyed ..... 4 Don't Know ..... 7 Not Ascertained ..... 8 Refused 9		(32)
6	While you've been at home this past month, have you been bothered or annoyed by aircraft noise? IF YES, ASK: Would you say you've been slightly annoyed by aircraft noise, moderately annoyed, very annoyed or extremely annoyed by aircraft noise?	No (Not at all Annoyed). 0 Slightly Annoyed ..... 1 Moderately Annoyed ..... 2 Very Annoyed ..... 3 Extremely Annoyed ..... 4 Don't Know ..... 7 Not Ascertained ..... 8 Refused 9		(33)

FIGURE C-1. QUESTIONNAIRE

ITEM	QUESTION	RESPONSE	CODE	CC
7	While you've been at home this past year, have you been bothered or annoyed by aircraft noise? IF YES, ASK: Would you say you've been slightly annoyed by aircraft noise, moderately annoyed, very annoyed or extremely annoyed by aircraft noise?	No (Not at all Annoyed) Slightly Annoyed Moderately Annoyed Very Annoyed Extremely Annoyed Don't Know Not Ascertained Refused	0 1 2 3 4 7 8 9	(33)
8	While you've been at home this past week, have you noticed any more or fewer airplanes than usual?	No Yes, fewer Yes, more Don't Know Not Ascertained Refused	0 1 2 7 8 9	(34)
9	While you've been at home this past week, were your windows generally open or shut?	Open Shut Don't Know Not Ascertained Refused	0 1 7 8 9	(35)

10 I'm going to mention a few things that sometimes concern people in neighborhoods like yours. Would you please tell me if they are of concern to you? Would you say you're (degree) concerned by (source)?

Concern	NAA	SLI	MOD	VRY	EXT	DK	NA	RF	CC
Air Pollution	0	1	2	3	4	7	8	9	(36)
Crime	0	1	2	3	4	7	8	9	(37)
Unemployment	0	1	2	3	4	7	8	9	(38)
Neighborhood Traffic Accidents	0	1	2	3	4	7	8	9	(39)
Aircraft Accidents	0	1	2	3	4	7	8	9	(40)
High Taxes	0	1	2	3	4	7	8	9	(41)
Heating Bills	0	1	2	3	4	7	8	9	(42)
Aircraft Noise	0	1	2	3	4	7	8	9	(43)

11 This past week, has aircraft noise: IF YES, ASK: Would you say that this happens rarely, occassionally or often?

	No	Rarely	Occasionally	Often	DK	NA	RF	CC
(a) Interfered with radio/TV listening	0	1	2	3	7	8	9	(44)
(b) Interfered with ordinary conversation in your home	0	1	2	3	7	8	9	(45)
(c) Disturbed your rest and relaxation	0	1	2	3	7	8	9	(46)

FIGURE C-1. (CONTINUED)

APPENDIX D

APPENDIX D

Table D-1 gives an accounting of the outcomes of contact attempts by interview site and round. Table D-2 presents completion rates calculated from the data of Table D-1. These rates decrease monotonically from 67% in the first round to 59% in the final round as the sampling frame aged.

TABLE D-1: ACCOUNTING OF RESPONDENT CONTACTS IN FOUR ROUNDS OF INTERVIEWING

ROUND 1: 14-16 October 1983

Area:	C	E	F	H	I	P	Q	R	T	U	V	Total
Completed Interviews	226	215	236	214	249	217	243	240	218	248	220	2526
Non-Sample:												
Tel. Out of Service	39	59	33	59	30	46	49	25	38	20	52	450
Wrong Address	13	14	10	9	10	19	15	20	8	7	12	137
Ineligible Respondent	14	13	7	3	7	5	9	9	6	5	15	93
Non-Responses:												
Unreached (5 attempts)	25	39	22	27	17	28	21	16	30	24	20	269
Refusal/Language	86	104	93	86	85	85	64	91	96	85	81	956

ROUND 2: 11-13 November 1983

Area:	C	E	F	H	I	P	Q	R	T	U	V	Total
Completed Interviews	220	217	254	224	256	223	241	238	248	281	229	2631
Non-Sample:												
Tel. Out of Service	38	52	36	74	40	57	53	40	30	26	68	514
Wrong Address	21	22	11	11	13	27	22	14	14	12	17	184
Ineligible Respondent	5	8	4	2	6	3	6	5	6	5	3	53
Non-Responses:												
Unreached (5 attempts)	41	48	24	27	18	27	22	23	27	25	23	305
Refusal/Language	116	119	117	104	112	97	104	123	116	97	105	1210

ROUND 3: 9-11 December 1983

Area:	C	E	F	H	I	P	Q	R	T	U	V	Total
Completed Interviews	243	244	237	243	238	224	234	274	251	243	236	2667
Non-Sample:												
Tel. Out of Service	40	67	41	87	33	68	42	37	42	32	72	561
Wrong Address	27	24	13	17	19	37	34	21	14	20	41	267
Ineligible Respondent	2	12	3	10	8	5	3	16	5	5	4	67
Non-Responses:												
Unreached (5 attempts)	43	37	26	30	35	33	24	22	17	25	33	325
Refusal/Language	146	116	129	114	111	123	112	137	121	125	116	1350

ROUND 4: 30-31 March and 1 April 1984

Area:	C	E	F	H	P	Q	R	T	U	Total
Completed Interviews	206	179	229	213	208	231	232	223	238	1959
Non-Sample:										
Tel. Out of Service	40	73	48	82	56	33	36	46	25	439
Wrong Address	17	27	16	17	24	34	21	15	15	186
Ineligible Respondent	7	10	5	7	4	12	6	7	8	66
Non-Responses:										
Unreached (5 attempts)	47	47	36	31	39	34	23	39	36	332
Refusal/Language	125	111	114	98	117	102	129	116	121	1033

TABLE D-2: PERCENT OF COMPLETED INTERVIEWS*

	ROUND 1	ROUND 2	ROUND 3	ROUND 4
Area:				
C	67	58	56	54
E	60	57	61	53
F	67	64	60	60
H	65	63	63	62
I	71	66	62	
P	66	64	59	57
Q	74	66	63	63
R	69	62	63	60
T	63	63	65	59
U	69	70	62	60
V	69	64	61	

*ratio of completed to completed plus non-responses (See Table C-1)